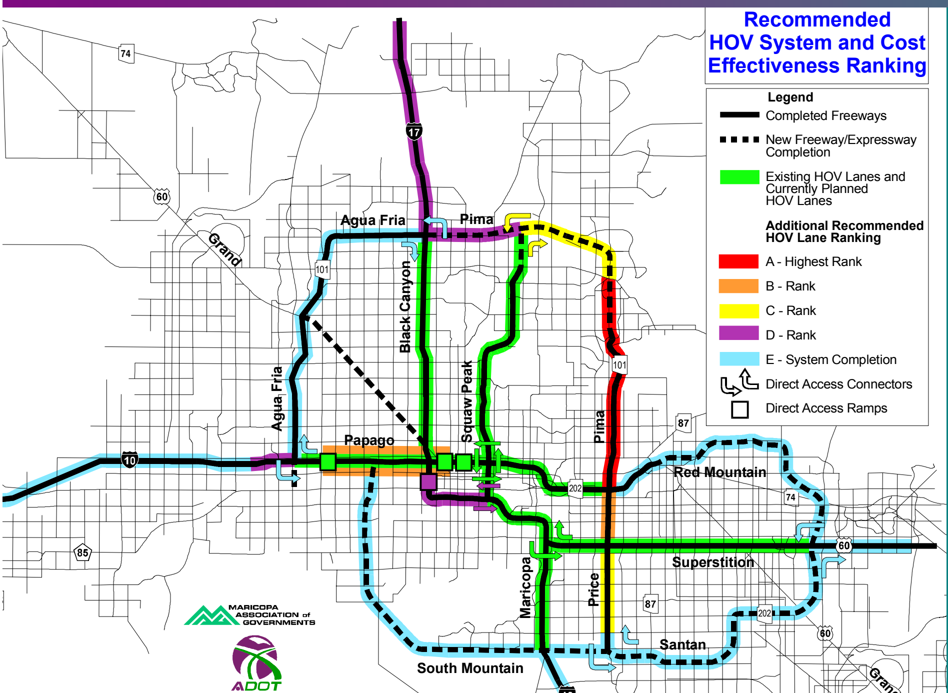
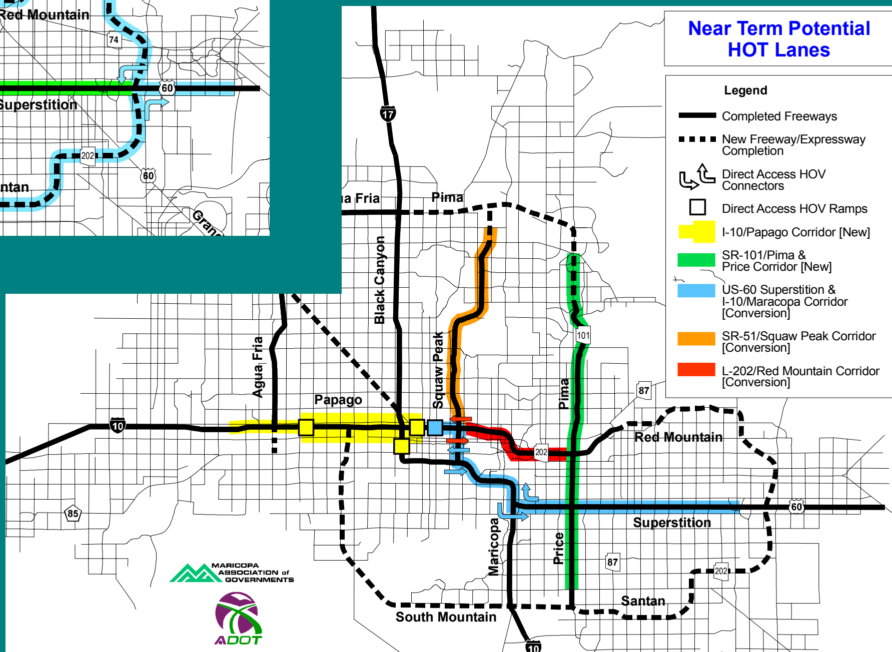
HIGH OCCUPANCY LANES AND VALUE LANES STUDY FINAL REPORT

December 2002





Prepared by

PARSONS TRANSPORTATION GROUP INC.

for

ADOT

ARIZONA DEPARTMENT OF TRANSPORTATION

in partnership with

MARICOPA ASSOCIATION of GOVERNMENTS

HIGH OCCUPANCY VEHICLE FACILITIES POLICY GUIDELINES AND PLAN FOR THE MAG FREEWAY SYSTEM

Prepared for:

Arizona Department of Transportation
Maricopa Association of Governments
Regional Public Transportation Authority

Prepared by:

Parsons Transportation Group Inc.

December 2002

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Acknowledgements:

Special thanks to Robert W. Poole, Jr., author of "*Building a Case For HOT Lanes: A New Approach to Reducing Urban Highway Congestion*" and published by the Reason Foundation, Los Angeles, CA

IN MEMORY OF JON H. GREEN

This document has been prepared in the memory of and is dedicated to Jon H. Green who was instrumental in its study, formulation and development of Value Lanes strategies and recommendations. Jon dedicated his efforts to develop this Value Lanes planning and implementation "Blueprint" that the Arizona Department of Transportation, Maricopa Association of Governments and the people of Maricopa County can use to address traffic congestion issues for many years to come.

SECTION 1: INTRODUCTION

The Arizona Department of Transportation (ADOT), in partnership with the Maricopa Association of Governments (MAG), contracted with Parsons Transportation Group to perform a Value Lane Study for the MAG Freeway System. In this context, Value Lanes represent a general concept by including High Occupancy Vehicle (HOV) lanes, as well as High Occupancy Toll (HOT) lanes. HOT lanes can best be described as new or existing HOV lanes that are opened to non-HOV (usually solo) drivers for a fee.

The purpose of the Value Lane Study was to provide information to policy makers on the MAG Regional Council and the State Transportation Board for use in updating the 1994 MAG HOV Plan and to assess the feasibility of converting HOV lanes to HOT lanes. Options were evaluated based on a wide range of factors. As a feasibility study, the financial, engineering and social support aspects of HOV and HOT lane concepts were evaluated and included in the recommendations.

The intent of this Study was to conduct a balanced evaluation of HOV and HOT lane concepts for the MAG Freeway System. HOV and HOT lane approaches were evaluated, alternatives were then synthesized and the best alternatives were selected. The selected alternatives were refined to produce the best approaches for implementation.

Background

ADOT, MAG, and the Regional Public Transportation Authority (RPTA) have worked together to develop a comprehensive HOV Plan for the region. The first report, entitled "MAG Freeway and Expressway Plan Update: Priority Treatment for High Occupancy Vehicles," was published in 1990. In 1994, a second report, entitled "High Occupancy Vehicle Facilities Policy Guidelines and Plan for the MAG Freeway System," was completed. The MAG Regional Council, the RPTA, and the State Transportation Board adopted the 1994 MAG HOV Plan. This plan is an integral component of MAG's current Air Quality and Congestion Management plans.

The MAG Region has approximately fifty (50) centerline miles of High Occupancy Vehicle (HOV) lanes in place. HOV lanes are currently open to carpools with two or more people during the peak periods (6:00 AM to 9:00 AM and 3:00 PM to 7:00 PM), and to all vehicles in the off-peak period.

The 1994 HOV Plan includes approximately 91 centerline miles of existing and planned HOV lanes, thirty (30) park-and-ride facilities, two on-line bus stations and two freeway-to-freeway HOV direct connectors. The majority of these HOV facilities will be implemented by 2007. Future plans for HOV facilities are to be included in this five-year update to the MAG HOV Plan.

Although HOV lanes enjoy considerable public usage, they have not resulted in wholesale changes in the way people commute. Today, most sections of the HOV system have considerable excess capacity during the peak hours, with the exception of I-10 between 79th Avenue and 3rd Avenue, which is at capacity. Moreover, the MAG Travel Demand Model predicts considerably more demand by 2020.

National Perspective

The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 provided for three pilot programs for congestion pricing on Interstate facilities. The 1998 Transportation Equity Act for the 21st century (TEA-21) provides for an expanded program under the value pricing provision of the act. FHWA has authorized demonstration HOT lane projects on I-15 in San Diego and on the Katy Freeway in Houston. HOT lanes have been successfully implemented on SR-91 in California.

Regional HOT Lane Initiatives

In 1993, a private consortium proposed to develop HOT lanes on I-10 and other corridors in the Phoenix area. This concept was approved by the MAG Regional Council and ADOT and then was submitted to FHWA for approval and funding. However, the proposal was not accepted.

More recently, a private consortium, identified as Metro Road, developed a proposal for toll facilities in the East Valley. This proposal included HOT lanes on the Superstition Freeway, Price Freeway and portions of the Pima Freeway. In 1997, the Metro Road proposal was withdrawn.

In 1997 and 1998, ADOT submitted two applications to FHWA to implement HOT lanes on I-10 and I-17, as part of a region-wide congestion pricing pilot project. However, neither of these applications resulted in HOT implementation.

Study

The overall study tasks and their flow are depicted in Figure 1. Within this framework, there were two parallel activities, as illustrated below.

Table 1-1 Value Lane Study Tasks: Two Parallel Activities

1. Update MAG's 1994 Long-Range HOV Plan ("High Occupancy Vehicle Facilities Policy Guidelines and Plan for the MAG Freeway System") for the post-2007 era *Result: Update to HOV System Plan*
2. Assess Potential for Value Lanes (e.g., High Occupancy Toll, HOT, Lanes) on MAG's Freeway System *Result: Fiscal Feasibility Evaluation of Value Lanes on the MAG Freeway System*

The Study tasks can be summarized as:

Task 1 Public Involvement Plan and Conduct
Task 2 Verification of the MAG Model Validation
Task 3 Base Case for 1998
Task 4 Adopted HOV Plan Case for 2010 and 2020
Task 5 Enhanced HOV Case for 2010 and 2020
Task 6 Base HOT Lane Case for 2010 and 2020

Task 7 Enhanced HOT Lane Case for 2010 and 2020
Task 8 Evaluation of and Selection of Option(s)
Task 9 Refinement of Selected Option(s)
*Task 10 Alternative HOV Evaluation (without Grand Avenue as Expressway)
Final Report Preparation and Presentation

*Note that "Task 10" was an add-on task to re-assess the HOV priority evaluation without Grand Avenue as an Expressway. This added task evaluation is provided in Appendix D.

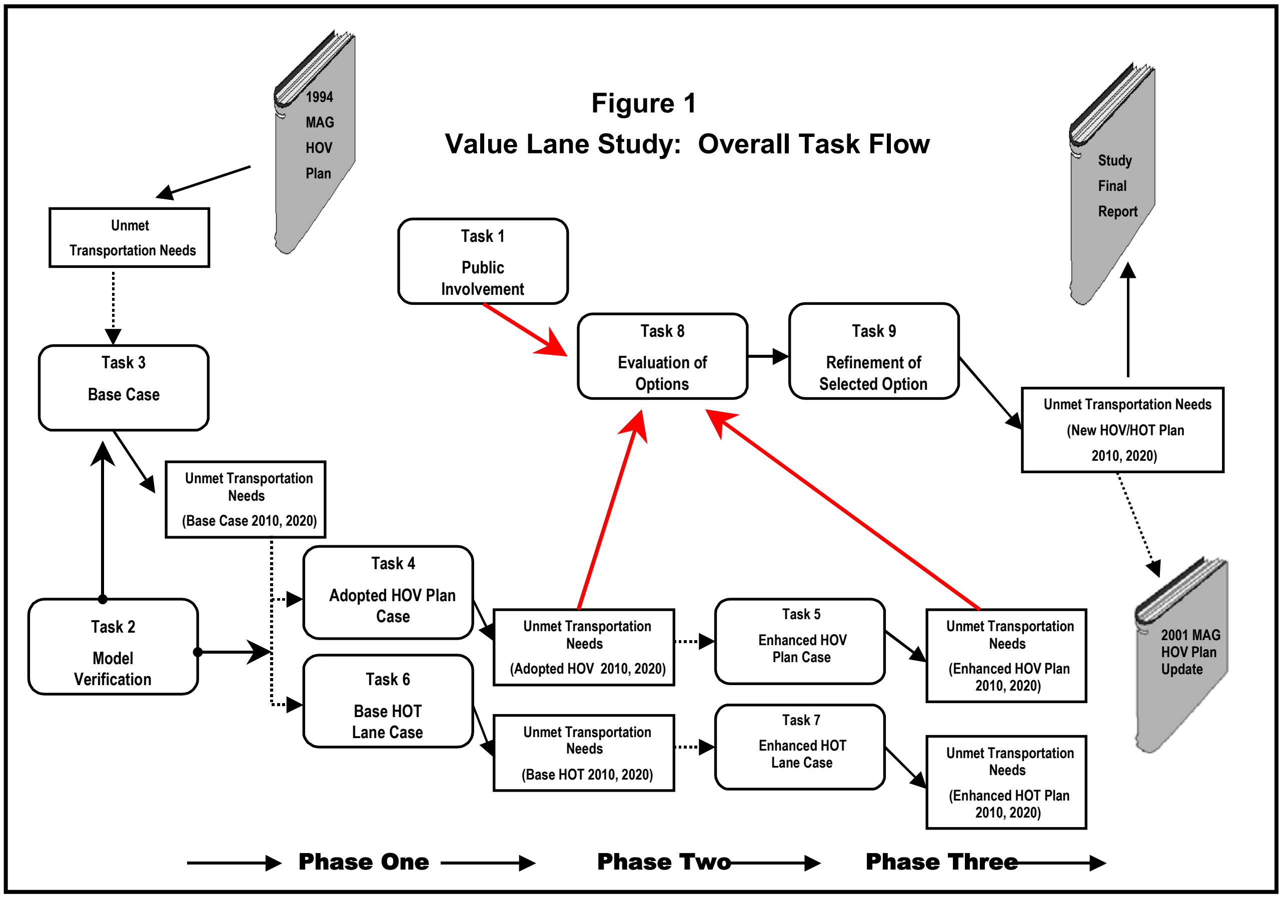


Figure 1
Value Lane Study: Overall Task Flow

Final Report

The Final Report contains two Executive Summaries: the HOV Plan Update and the HOT Feasibility Results. This final study report main body examines existing travel conditions in the MAG Region and defines Guiding Principles for planning HOV and HOT lanes in Section 2, the Results of the Public Involvement Activities in Section 3, the Recommendations for HOV Lanes and Connectors in Section 4, Recommendations for Direct HOV Access Ramps in Section 5,, Recommendations for HOV By-pass On-Ramps in Section 6, and the Value Lanes Recommendations in Section 7. In addition, from other studies, the Express Bus Service and Park-and-Ride Lots Plan Updates are summarized in Section 8. The Demand Management and Enforcement elements are discussed in Section 9. The Implementation of HOV and HOT Recommendations are discussed in Sections 10 and 11, respectively. Section 11 also provides a discussion of a number of HOT lane implementation aspects, including equity and social justice issues, regulatory requirements, funding sources, the FHWA Value Pricing Program requirements (for a pilot project), a monitoring plan, a public communications plan, and a pilot project implementation study. The Action Plan for Implementation is described in Section 12. Finally, the Study Conclusions are presented in Section 13.

The products of the Study are included in the following appendices:

Appendix:	**Task:**	**Report:**
A	Task 1	Public Opinion Survey
A.1	Task 1	Survey Results
A.2	Task 1	Survey Assessment
B	Task 1	Focus Group #1 Report
C	Task 1	Focus Group #2 Report
D	"Task 10"	Alternative HOV Assessment
E	Tasks 6 and 7	HOT Feasibility Assessment

SECTION 2: BACKGROUND AND GUIDING PRINCIPLES

2.1 Need for HOV/HOT Improvements – Congestion in Maricopa County

Freeway traffic in the MAG Region is getting worse every day. As the region continues its fast-paced economic and residential growth, traffic continues to clog freeways, especially during morning and evening rush periods.

With a fifty (50) percent population increase projected over the next twenty (20) years, and a corresponding seventy (70) percent increase in travel throughout the region, even an aggressive freeway construction program will have difficulty keeping pace with growth. State and regional transportation planners are saying that new ways need to be found to move more people and effectively manage the region's growing traffic congestion problem.

Residents are acutely aware of these problems. On a scale of 1 to 10, with 10 meaning that transportation is a very important problem in the Valley, 69 percent of residents surveyed in late 1999 ranked transportation between 8 and 10; only five (5) percent of the respondents ranked it between 0 and 3.

For 20 years, high occupancy vehicle lanes have been regarded as a transportation management concept that offers multiple benefits. They are intended to encourage ridesharing and raise vehicle occupancy. By only allowing access to vehicles with two or more passengers,, HOV lanes are able to increase the people-moving capacity of the freeway system. Fewer vehicles utilize the carpool lane than the regular freeway lanes, but each carpooling vehicle carries more people.

The MAG Region's first HOV lanes opened in 1988 along a six-mile stretch of the I-10 Freeway, and today approximately fifty (50) centerline miles of lanes exist, with most of the lanes located on I-10, State Route 202, and I-17. HOV lanes operate each weekday morning from 6 to 9 a.m. and afternoon from 3 to 7 p.m. During the remainder of the day, these HOV lanes are available to all vehicles.

The region's experience with HOV lanes has been mixed. The I-10 Freeway west of the I-17 interchange receives extremely heavy use. A recent Maricopa Association of Governments' (MAG) study vividly demonstrated the people-moving capacity of these lanes. The study showed that the eastbound I-10 HOV lane at 39th Avenue carried more people during the average peak morning rush hour (3,250 people) than the average in each of the three regular-use lanes (2,250 people). During the average evening peak period, the westbound I-10 HOV lanes carried 2,000 more people than in each of the three regular-use lanes; however, other HOV lanes are not heavily used. These peak-period numbers, however, do not reflect the fact that the lanes operate far under capacity during non-peak periods.

The lanes also enjoy strong support in the community. Seventy-nine (79) percent of respondents in the study's survey stated that they were familiar with the region's carpool lanes and had used them; 86 percent of those surveyed approved of the HOV concept, and a remarkable 66 percent said that they strongly approved of the concept. Additionally, nearly 75 percent of those surveyed agreed that more HOV lanes should be built on the region's freeways. This data supports plans to add HOV lanes.

The selling of excess HOV lane capacity for a fee to non-carpoolers (HOT lanes) has been identified as an approach to expand the use of HOV lanes to serve a greater variety of users and generate additional revenue. A key consideration toward attracting toll-paying non-carpoolers to the High Occupancy Toll (HOT) lanes is to ensure that smooth flowing travel conditions are maintained for all users at all times. Congestion or value pricing (i.e., adjusting the tolls for the HOT lane during periods of high traffic volumes) can be used to maintain these smooth flowing conditions. These two separate concepts are often intertwined. HOT lanes are a method to sell excess HOV lane capacity. Congestion or value pricing is a method to adjust the volume of non-carpoolers on the HOT lane to ensure smooth flowing traffic conditions by using price as the travel demand management control.

For clarification, the toll paid by a HOT Lane user is defined as a “premium fee” for the benefits of travel time savings and reliable travel in contrast to the congested general purpose lanes on the same corridor. Toll paying and non-toll paying users pay user fees, such as gas taxes, for use of the basic freeway transportation network. Thus, the toll paid is not “paying twice” for the same road, but rather, paying once, through user fees, for the basic freeway network, and paying a “premium” to receive the benefits of a trip travel time savings and reliable and smoother travel.

2.2 Scope, Purpose and Limitations of Value Lanes Study

This study evaluated existing, planned and potential enhancements to HOV facilities, including HOV lanes, HOV ramp meter bypass ramps, direct access to and from HOV lanes, and HOV direct connectors (ramps) between freeways. In addition, the feasibility of implementing HOT or Value Lanes on Valley freeways was studied. These enhancements were studied for the years of 2010 and 2020.

Traffic forecasts were developed using the new MAG regional transportation model by MAG staff, in collaboration with Parsons Transportation Group Inc., the Consultant. The freeway network was based upon the currently approved Regional Transportation Plan.

In the remainder of this section, the guiding principles used for the HOV and HOT lanes aspects are described.

2.3 HOV Guiding Principles

The development and implementation of a successful HOV system is based on guiding principles that apply to the mainline freeway HOV facility, freeway-to-freeway HOV connectors, HOV direct access ramps and HOV bypass lanes at freeway on-ramps. The information below summarizes the HOV guiding principles that were used in the development of the MAG HOV System Plan update.

2.3.1 Mainline HOV Facilities

The primary objective of HOV facilities is to preserve mobility within congested freeway corridors by offering a travel time incentive to those individuals willing to share a ride. Maintaining a high level of service within the HOV facility, compared to the adjacent mixed flow lanes, encourages commuters to rideshare and, in turn, reduces vehicle miles of travel.

The success and utilization of HOV facilities is dependent on congestion occurring in the adjacent mixed-flow lanes. Without congestion in the mixed-flow lanes, there would not be a travel time incentive to encourage commuters to rideshare and use the HOV facility. While HOV facilities do not eliminate freeway congestion, they do provide increased mobility, improve travel time reliability and safety as well as contribute to smoother traffic operations in congested freeway corridors.

The separation of the HOV lanes from the adjacent mixed-flow lanes can be accomplished via barrier or buffer separation. The most common type of separation used is buffer separation, as it requires less right-of-way than barrier separation. Different areas of the country employ buffer separations that vary from as narrow as a one-foot separation to as wide as a 14-foot separation. The MAG HOV System is separated with a painted buffer that allows continuous access to the HOV facility. Examples of these buffers are shown in the photographs of the I-10 HOV lanes in Figure 2-1.

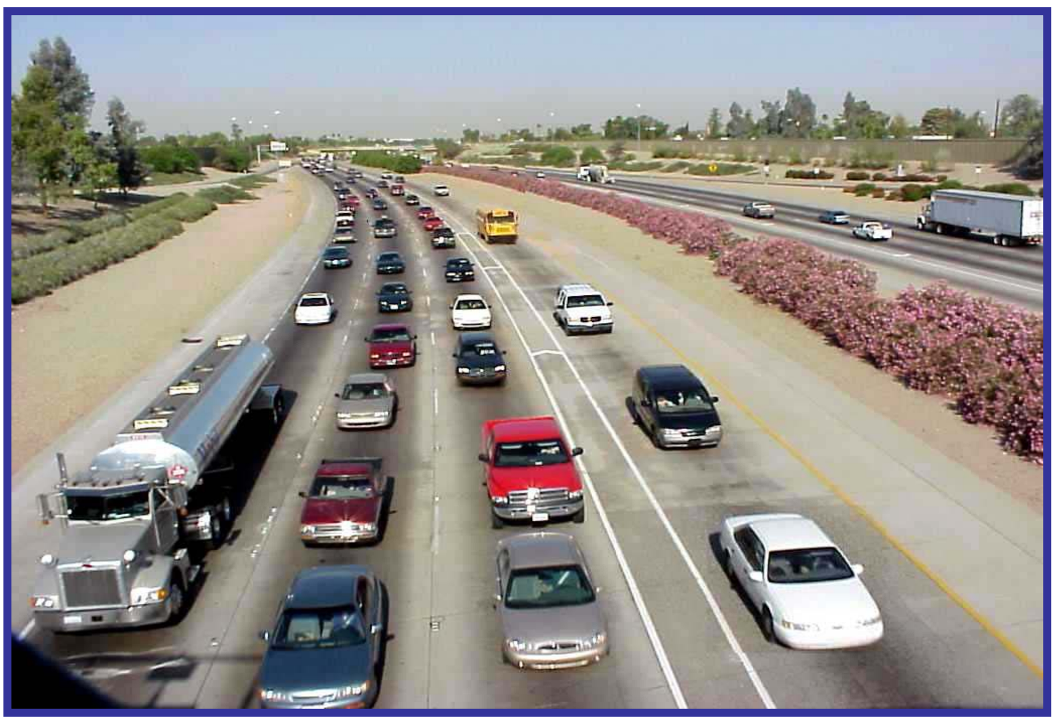
The requirement for HOV occupancy in the MAG Region is two or more occupants. A guiding principle in this study was maintaining this existing two-person HOV occupancy requirement for as long as feasible. The shorthand term used is HOV-2+ (as the carpool requirement is two or more occupants). Once the HOV-2+ lanes are filled to capacity, the primary option will be to change the HOV occupancy requirement to three-person carpools. Nonetheless, the guiding principle followed was to delay that step as long as possible.

Another applicable principle for this study is that the maximum capacity threshold used for HOV lanes during peak travel times is 1,500 vehicles/lane/hour (vplph) for single lane facilities and 1,700 v/l/hr for two-lane facilities to be at or above level of service (LOS) D (see Appendix E, Table E-4). These allowances are generally accepted practice based upon observations and capacity reduction factors. For this study, the capacity for a single HOV lane is based upon the roadway design, less peak period, capacity-constraining conditions (ref. TRB Special Report 209, Highway Capacity Manual (HCM); TRB NCHRP Report 414, HOV Systems Manual). These capacity-constraining conditions include: roadway and shoulder geometric design (e.g., barriers, buffers, median, frequency of ingress/egress locations etc.); operational variations (e.g., congested mixed-flow traffic, weaving, etc.); vehicle makeup of HOV traffic flow (content of transit buses/trucks); and driver perception (behavior) to reduce speed and increase headway when driving next to congested or stopped traffic. The capacity for a two-lane facility is typically greater than a single lane due to fewer geometric constraints and capacity reducing factors.

An additional guiding principle for HOV lanes is derived from operational experience regarding the termini of HOV lanes. When HOV lanes terminate, they should do so at least one mile prior to or following a freeway-to-freeway interchange, depending upon the HOV lane volume. The 1994 HOV Plan showed a number of planned HOV lanes terminating at freeway-to-freeway interchanges. This method of termination is not recommended as it combines the weaving impact of lane termination with the weaving that occurs at freeway-to-freeway interchanges. The guiding principle is to allow at least one mile of separation between the HOV lane terminus and any freeway-to-freeway interchange.

The evaluation of existing and proposed mainline HOV facilities was determined using the screening criteria shown in Table 2-1. It is not essential that all six criteria thresholds be satisfied; however, it is essential that the minimum volume and person movement thresholds be met. In addition, the ultimate determination of the effectiveness of candidate HOV facilities can be assessed using the cost effectiveness criterion (i.e. item 6 in Table 2-1). This criterion takes into consideration several of the other criteria (i.e. HOV volumes, person movement, reliable travel time savings and cost) to be able to give an indication of the cost of the facility for each person-hour of travel time savings. Further discussion of how this was used on the MAG HOV System Plan Update is presented in Section 4.

Figure 2-1
HOV Facilities: I-10 HOV Lanes



2.3.2 Freeway-to-Freeway HOV Connectors

The purpose of freeway-to-freeway HOV connectors is to allow direct access from HOVs to other freeway facilities, thereby enhancing their travel time benefit. The direct HOV connectors allow HOVs to access the crossing freeway without having to exit the HOV lane. The direct HOV connector eliminates the need for the HOV to weave across several lanes of congested mixed flow traffic, use the mixed flow connector and then weave across mixed flow traffic to access the crossing freeway HOV facility. Thus, the safety in the mixed flow lanes is improved by the addition of freeway-to-freeway direct connectors. Figure 2-2 shows an aerial view of the one existing freeway-to-freeway HOV connector in the MAG area to/from I-10/Papago and SR-202/Red Mountain. Figure 2-3 shows this HOV connector from ground level views.

ADOT is currently constructing a direct connector from I-10 to US-60 as part of a project to add HOV lanes to be opened on US-60 in 2003. ADOT will also add another direct connector between I-10 and SR-51 in 2003 (begin construction).

Freeway-to-freeway HOV connectors should only be implemented where they are most viable, as they are large, costly structures. Typical structures are shown in Figure 2-4, where the connectors between I-105 and I-110 (in Los Angeles) involve flyover bridge designs. The viability of the HOV connectors was evaluated using pertinent HOV connector screening criteria as shown in Table 2-1. The six criteria shown in Table 2-1 provide a reasonable indication of the benefits and costs associated with the implementation of an HOV connector. It is not essential that all six criteria thresholds be satisfied; however, it is essential that minimum volume (i.e., 600 vehicles/hour during peak periods) and person movement thresholds (i.e., 2000 persons/hour) are met.

The volume and person movement criteria indicate the degree of utilization (both actual and perceived) needed to justify implementation of these usually high-cost connectors. There may be situations where retrofitting an HOV connector into an existing freeway-to-freeway interchange results in a high implementation cost and a correspondingly low cost-effectiveness rating. However, the level of usage and overall benefits to the freeway and HOV system may still make constructing the HOV connector viable.

Table 2-1
HOV Corridor Screening Criteria

PRIMARY CRITERIA	(MOE) MEASURE OF EFFECTIVENESS	THRESHOLD
1. Travel Time Savings	Forecast HOV AM and PM peak hour time savings compared to general purpose lanes	1 Less than 0.3 min/mile 3 0.3 - 1.0 min/mile 5 Greater than 1.0 min/mile
2. HOV Lane Volume	Forecast peak hour vehicle volume	1 Less than 600 HOV-2- peak hour vehicles (1,500 for take-a-lane) 3 600-800 HOV-2 peak hour vehicles (1,500 to 1,700 HOV-2 for take-a-lane) 5 Greater than 800 HOV-2 peak hour vehicles (1,700 for take-a-lane)
3. HOV Person Movement	Forecast peak hour person movement	1 Less than 2,000 peak hour people (3,000 for take-a-lane) 3 2,000-2,600 peak hour people (3,000 to 3,400 for take-a-lane) 5 Greater than 2,600 peak hour people (3,400 for take-a-lane)
4. Transit System Integration	Savings in bus operating time due to HOV facility	1 No savings 3 0 to 10% savings 5 Greater than 10% savings
5. Design Acceptability	Clearances (shoulder and buffer)	1 Both shoulder and buffer non-standard greater than 20% of segment length 3 Either shoulder or buffer non-standard greater than 20% of segment length 5 Both shoulder and buffer non-standard less than 20% of segment length
6. Cost/Effectiveness	Cost/benefits change (annualized implementation cost divided by annualized person hour travel time savings)	5 < $2.50 4 >$2.50 & <$5.00 3 >$5.00 & <$10.00 2 >$10.00 & <$20.00 1 >$20.00

Legend:		
	1	**Criteria Not Attained**
	2 3 4	**Criteria Attained**
	5	**Criteria Exceeded**

Figure 2-2
Aerial View of HOV Facilities
Direct Freeway-to-Freeway HOV Connectors

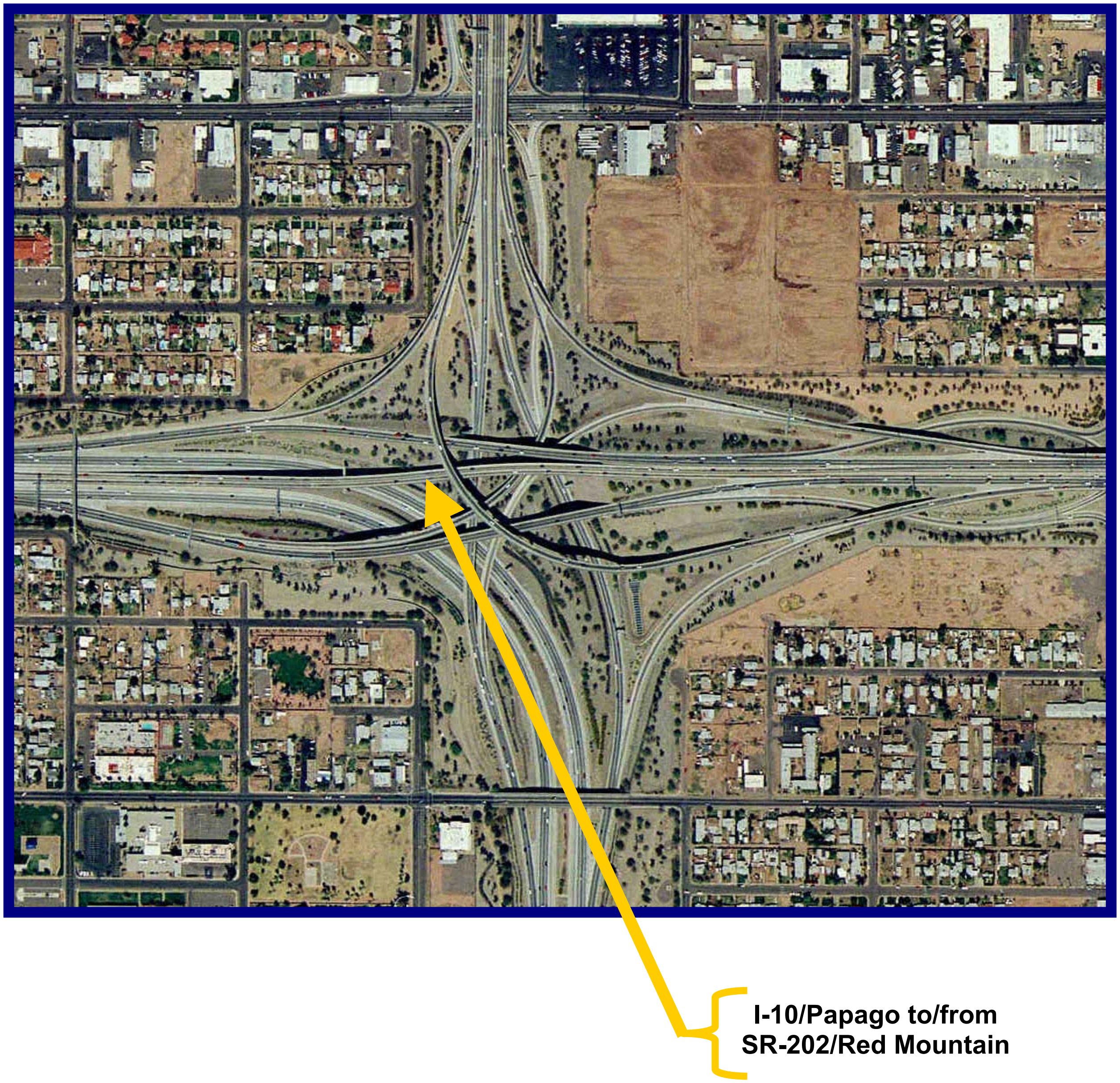


Figure 2-3
Ground Level View of HOV Facilities
Direct Freeway-to-Freeway HOV Connectors
At I-10/Papago and SR-202/Red Mountain

Another guiding principle developed from this study is that, as direct freeway-to-freeway HOV connectors are identified, new freeway interchanges can be redesigned to accommodate these future HOV connectors at a relatively low additional cost. During this study, the designs for two freeway interchanges (specifically, SR-101/Price at SR-202/Santan, and SR-51/Squaw Peak at SR-101/Pima) were altered at a relatively low additional cost to include ROW and space for future direct HOV connectors. In both cases, the flow directions of the connectors were selected to affect this design accommodation. To carry this principle to its natural conclusion, recommended freeway-to-freeway HOV connectors and their directions will be included in future HOV plans.

Figure 2-4:
HOV Facilities
Direct Freeway-to-Freeway HOV Connectors
(I-105/I-110 Typical Example)

2.3.3 HOV Direct Access Ramps

Direct HOV access ramps (shown in Figure 2-4) provide dedicated connections between the overpassing or underpassing arterial street and the freeway HOV lane. The direct HOV access ramp eliminates the need for the HOV to weave across several lanes of congested mixed flow traffic to use the mixed flow ramp to exit (or vice versa to enter). Thus, the safety in the mixed flow lanes is improved by the addition of HOV direct access ramps. Figure 2-5 shows examples of the existing direct access ramps at I-10 and 3rd Street from an aerial view. Similar to freeway-to-freeway HOV connectors, HOV direct access ramps afford the opportunity for HOVs to maximize their travel time benefits by avoiding the need to exit the HOV facility.

The criteria used to evaluate the HOV direct access ramp locations would be similar to those shown for the freeway-to-freeway HOV connectors. The simplest method of implementing HOV direct access ramp locations is to accommodate them within the freeway median and realign the general-purpose lanes around the direct access ramps. The cost to construct HOV direct access ramps can be significant due to the right-of-way impacts to the existing land use within urbanized areas, plus major reconstruction of the existing freeway system. The ground level views of the pair of direct access HOV on/off ramps at I-10 and 3rd

Street are shown in Figure 2-6. These photographs illustrate the size of such structures. For the above reasons, it is usually best to construct direct access ramps in major destination areas (i.e. the downtown area) or areas where there will be bus rapid transit vehicles frequently accessing the freeway/arterial system.

2.3.4 HOV Bypass at On-Ramps

Lastly, consideration must also be given to the concept of HOV bypass lanes at freeway on-ramps. Examples of these HOV bypass lanes are shown in Figure 2-7. On-ramp HOV bypass lanes also provide a means of extending the travel time benefit for HOVs by allowing them to bypass single-occupant vehicles at ramp meter locations. Nearly all of the freeway on-ramps within the MAG Freeway System contain two lanes. The concept of HOV bypass lanes at two lane on-ramps, where one lane is dedicated for use as an HOV by-pass lane and the other is for general-purpose traffic, works well when traffic volumes are relatively low and the cross street provides one left turn lane entering the on-ramp. However, at high-volume on-ramp locations, or where dual left turn lanes enter the on-ramp, operational and enforcement problems can develop due to the limited capacity provided via one lane designated for general-purpose use. Given the above situation, it would be appropriate to consider two potential options for this type of on-ramp configuration as discussed below:

> *Option 1:* **Two-Lane General Purpose On-Ramp -** This first option is to provide two general-purpose lanes at the on-ramp and not have an HOV bypass lane. This would be the low-cost option and would be viable, provided there is not a high-volume transit center or large park-and-ride lot in the near vicinity.
>
> *Option 2:* **Three-Lane On-Ramp (two general-purpose lanes and one HOV bypass lane) –** This second option is to provide one HOV bypass lane and two general-purpose lanes, creating a three lane on-ramp. This option would require additional right-of-way and would therefore be more costly than the first option. This type of configuration should be considered near park-and-ride lot locations and where significant express bus access is planned and there are no physical or financial constraints.

Figure 2-5
Aerial View of HOV Facilities:
Direct Access Ramps for HOV Lanes (I-10 to/from 3rd Street)

Figure 2-6
HOV Facilities:
Direct Access Ramps for HOV Lanes
(I-10 to/from 3rd Street)

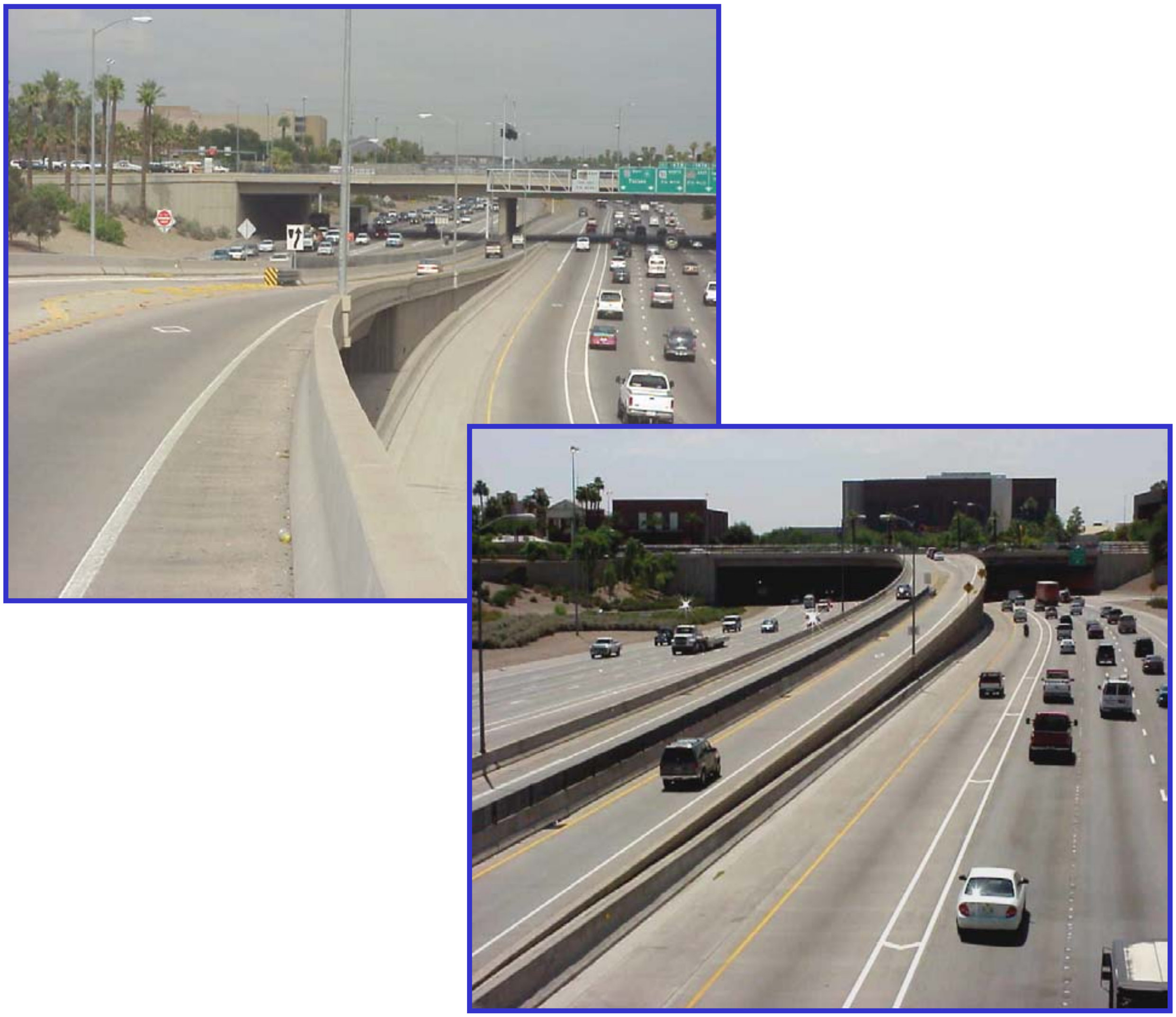


Figure 2-7
HOV Facilities:
Bypass Lane Ramps

2.4 HOT Lanes Guiding Principles

High Occupancy Toll (HOT) lanes can best be described as new or existing HOV lanes that are opened to drivers who are not eligible for carpool lanes (i.e., non-HOV, usually solo drivers) for a fee. When fees are based upon the congestion levels in the corridor, then lanes are using the concept of value pricing. Value pricing is a market-based approach to traffic management that involves charging higher prices for travel on roadways during periods of peak demand. Also known as congestion pricing or road pricing, value pricing is intended to make better use of existing highway capacity by encouraging some travelers to shift to alternative times, routes, or modes of transportation. When HOT lanes employ value pricing, they are best described as Value Lanes, which provide a travel demand management tool to transportation authorities for making effective use of the HOV lane capacity.

According to a Reason Foundation study[1], there are at least four circumstances under which HOT lanes may be appropriate:

1. If an existing two- or-more-persons-per-vehicle (HOV-2+) lane is seriously underutilized, converting it to a HOT lane makes use of this excess capacity.
2. If an existing HOV-2+ lane becomes congested and is set to be converted to an HOV-3+ lane (three or more persons per vehicle), experience indicates this will lead to a large amount of excess capacity. This also provides the opportunity to sell the excess capacity by converting to HOT lanes.
3. When an existing congested freeway is programmed for capacity expansion, the addition of a HOT lane in either direction may offer more benefits than adding either a conventional HOV lane or a general-purpose lane.
4. When a new freeway is to be built, fewer lanes might be possible if a value pricing HOT lane concept is employed to limit demand during peak hours.

Additionally, capacity allowances for HOV and HOT lanes use a maximum threshold of 1,500 vehicles per lane per hour (vplph) for one-lane facility and 1,700 vplph for two-lane facility in order to be at or above level of service (LOS) D (see Appendix E, Table E-4). It is recommended to not allow toll payers into HOT lanes when HOV volumes exceed 1,400 vplph for single lane, and 1,600 vplph for two lanes. This constraint is due to the toll rates start to become excessive when trying to limit toll payers into the 100 vplph cushion and dynamic road pricing begins to break down and does not provide sufficient demand management control. It is also noted, for this study, that the capacity for a single HOV lane is based upon the roadway design, less peak period, capacity-constraining conditions (ref. TRB Special Report 209, Highway Capacity Manual (HCM); TRB NCHRP Report 414, HOV Systems Manual). These capacity-constraining conditions include: roadway and shoulder geometric design (e.g., barriers, buffers, median, frequency of ingress/egress locations etc.); operational variations (e.g., congested mixed-flow traffic, weaving, etc.); vehicle makeup of HOV traffic flow (content of transit buses/trucks); and driver perception (behavior) to reduce speed and increase headway when driving next to congested or stopped traffic. The capacity for a two-lane facility is typically greater than a single lane due to fewer geometric constraints and capacity reducing factors.

New technology

In particular, non-stop electronic toll collection methods, which use vehicle-mounted transponder tags, make HOT lanes feasible without the need for tollbooths or toll plazas. These

[1] *Building A Case For HOT Lanes: A New Approach to Reducing Urban Highway Congestion,* by Robert W. Poole, Jr., and C. Kenneth Orski.

transponders also allow HOT lane operators to institute dynamic pricing (generally referred to as "value pricing"). The practice of varying tolls depending upon the congestion in the HOT lanes helps ensure free-flowing traffic in the HOT lanes.

2.4.1 Background

The HOT lane concept, first articulated in 1993 by Gordon J. Fielding and Daniel B. Klein in a paper published by the Reason Foundation, has found its first real-world application in three projects so far. Two of these three HOT lane projects have employed value pricing. Similarly, a toll bridge in Lee County, Florida, has employed value pricing in a recent pilot project. These four U.S. projects are summarized below:

91 Express Lanes — An innovative private sector value pricing project on SR-91, in Orange County, California, the 91 Express Lanes is the first fully automated variably priced toll road in the United States. The project is privately owned and operated under a franchise agreement between the California Private Transportation Company (CPTC) and the State of California. The 91 Express Lanes opened in December 1995 as a four-lane toll facility in the median of a 16-kilometer section of one of the most heavily congested highways in the United States. The toll lanes are separated from the general-purpose lanes by a painted buffer and plastic pylons, as illustrated in Figure 2-8.

Tolls on the 91 Express Lanes vary between $0.75 and $4.25, depending upon the time of day. These tolls reflect the level of congestion delay avoided in the adjacent free lanes. The toll amount is used to maintain free-flow traffic conditions on the toll lanes. All vehicles must have a FasTrak™ transponder (see Figure 2-9) to travel on the 91 Express Lanes. Carpool vehicles (defined as three or more occupants) initially drove for free, but now HOVs pay 50% of the toll.

Figure 2-8
91 Express Lanes in California Use Value Pricing to Control Traffic Congestion

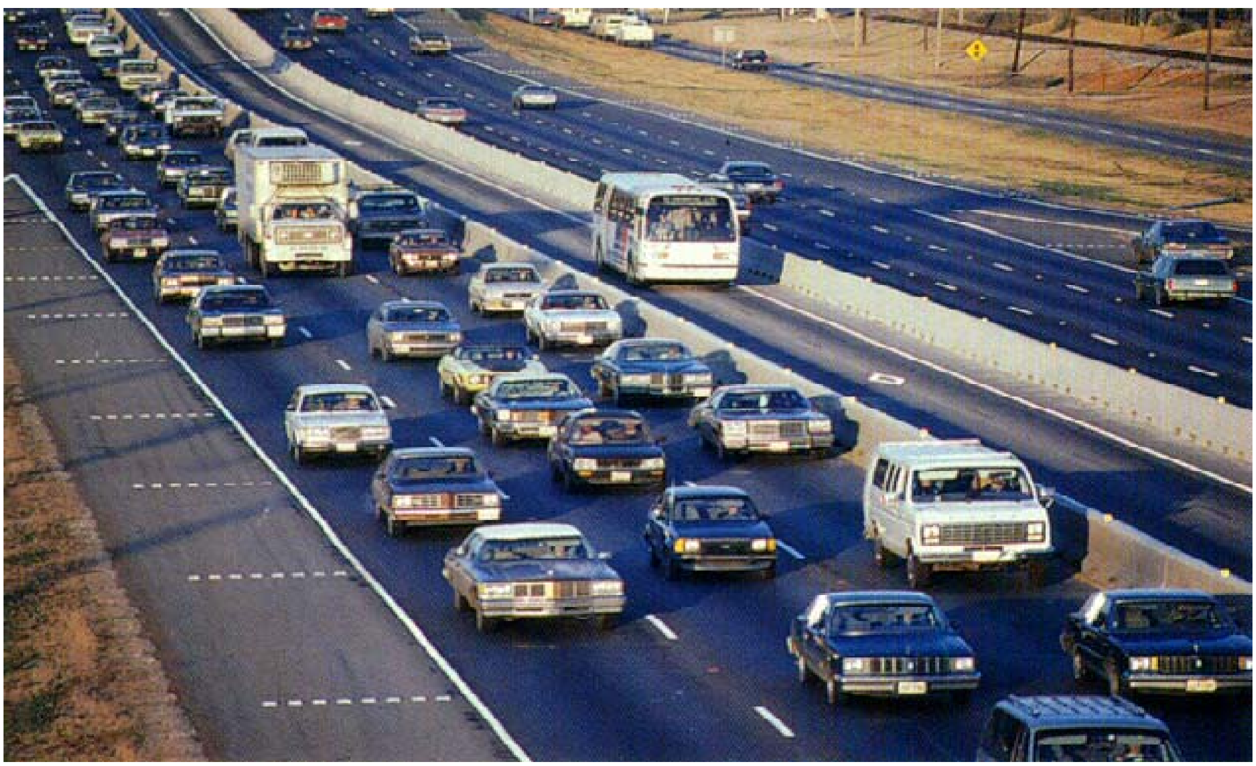
Figure 2-9
FasTrak™ Transponders Used on California Toll Roads

I-15 Express Lanes — Initiated in December 1996, San Diego's value lane project is on Interstate 15 (I-15) and allows single-occupant vehicles (SOVs) to use the existing HOV-2 lanes for a fee. This Value Pricing Pilot Project is managed by the San Diego Association of Governments (SANDAG), with the intent of improving transportation service on the I-15 by using excess capacity in the HOV lanes and generating revenue for transit service improvements in the I-15 corridor. The I-15 Express Lanes use FasTrak™ transponders and overhead antennas (using an open communications protocol, as dictated by the California state code's Title 21) to collect tolls electronically from the SOV customers who pay a per-trip fee each time they use the facility. Pre-paid transponder accounts are established by the customers with the operator, SANDAG, who issues the I-15 FasTrak™ transponders. The I-15 facility is approximately a 10-mile pair of reversible HOV lanes in the center median of I-15 in northern San Diego County, California. The I-15 Express Lanes are barrier-separated as shown in Figure 2-10. The normal toll varies between $0.50 and $4.00 and is based upon traffic levels in the HOV lanes and the time of day. During very congested periods, the toll can rise as high as $8.00. The unique feature of the project is that fees change dynamically with the current level of congestion, as measured by sensors on the HOV lanes. Fees can vary in 25-cent increments as often as every six minutes to help maintain free-flow traffic conditions on the Value Lanes. Recently enacted State legislation allows the I-15 Express Lane program to continue to operate beyond January 1, 2002. The project is fully self-sufficient, generating approximately $1.2 million in revenue per year with operating expenses of less than $0.9 million, providing over $0.3 million annually for bus transit projects in the corridor.

Figure 2-10
I-15 Express Lanes in San Diego Uses Dynamic Value Pricing
to Control Congestion and Provide Revenues for Transit in the Corridor

Houston QuickRide Program — Travelers in the Katy Freeway (I-10) Corridor in Houston, Texas, are being offered an opportunity to improve their peak-hour commutes through value pricing. The Katy HOV lane, normally restricted during the peak hours to buses and carpools with three or more people (HOV-3+), is now available to two-person carpools who register in the QuickRide program and pay a $2.00 fee for each trip. The QuickRide program is operated by the Metropolitan Transit Authority of Harris County (METRO) and Texas Department of Transportation (TxDOT). In 1988, when the 13-mile, barrier-separated, single reversible lane facility (shown in Figure 2-11), became congested with two-person carpools and buses, METRO and TxDOT restricted peak hour use to HOV-3+ carpools. This reduced the number of vehicles by 50% and people movement during the peak hour by 30%. In January 1998, in order to attract traffic back onto the HOV lanes without giving up the speed advantage of the lanes, METRO developed a program that allows a limited number of two-person carpools back onto the HOV lane during the peak hours in return for the payment of a flat $2.00 fee. The fee is collected using transponders issued by METRO to a limited number of carpools. Since this program only applies to the peak hour for a one-lane facility, less than 1000 transponders are issued by METRO to QuickRide participants.

Figure 2-11
Houston's Katy Freeway Allows Peak Periods Access Into HOV-3+ Facility for Two-Person Carpools Willing to Pay a Fee



"LeeWay" Variable Pricing Program — In August 1998, Lee County, Florida, implemented value pricing on two toll bridges: the Cape Coral Bridge and the Midpoint Memorial Bridge. These bridges, with between 60,000 and 65,000 average weekday vehicle crossings, are heavily used by commuters. Implementing pricing strategies on these two toll bridges allows them to act as "throttles" for a large portion of the County's roadway network. The Lee County pricing strategy provides bridge patrons with a discount toll during selected off-peak hours as an incentive to encourage changing their trip-making from peak to off-peak hours. Currently, the LeeWay value pricing plan provides a 50% toll discount for trips made during "shoulder" periods (e.g., immediately prior to and after morning and evening peak periods). The LeeWay project has successfully moved traffic out of the peak congestion periods, allowing improved service to bridge patrons.

2.4.2 Guiding Principles for HOT Lanes

HOT lanes can accomplish several goals:

- By filling up underutilized carpool lanes, HOT lanes keep HOV lanes at their optimum usage;
- By diverting some solo drivers from the adjoining general-purpose lanes, HOT lanes help to reduce congestion in those lanes;
- By collecting fees for usage, HOT lanes generate revenue for transportation corridor improvements, both highway and transit; and
- By offering significant time saving, HOT lanes provide a travel option to solo drivers who need the time saving and are willing to pay a premium for the privilege during congested travel periods.

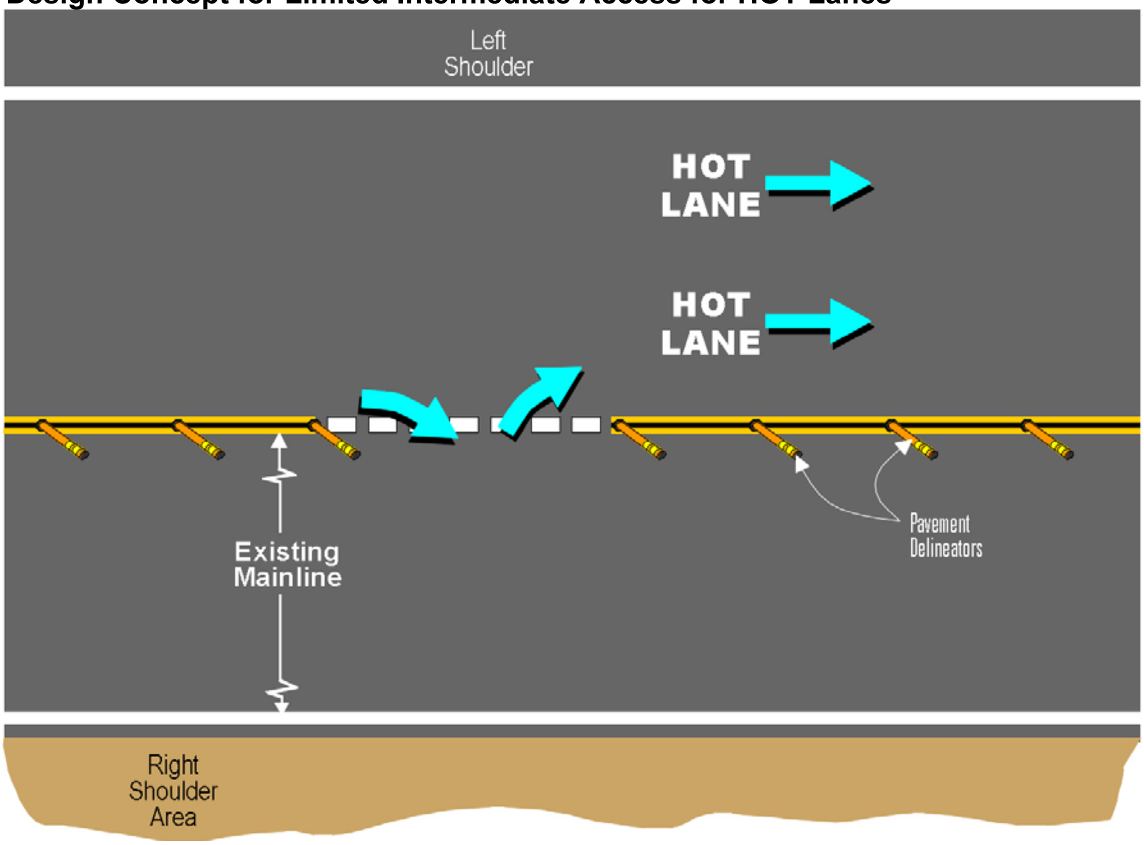
To assess the feasibility of Value Lanes for the Maricopa region, some guiding principles were established for the study. These HOT, or Value Lane, guiding principles will be described in the following subsections.

a. **Separation and Limited Intermediate Access** — Currently, MAG Region's carpool lanes provide unlimited access (i.e., crossing the solid white line into or out of the HOV facility is allowed at any location for carpoolers). However, this would not be operationally viable for HOT lanes due to the safety concerns caused by motorists weaving in the vicinity of toll collection zones. Therefore, HOT or Value Lanes need to be separated from general-purpose lanes (either using concrete barriers or fixed plastic pavement delineators in painted buffers). Likewise, the ingress/egress areas need to be restricted to designated locations that are <u>not</u> adjacent to the toll collection zones. The concept is illustrated in Figure 2-12. HOT lanes with intermediate access have not been implemented.

   Generally, experience and monitoring shows that motorists are unlikely to use HOV facilities for trips of less than two or three miles. Based upon that, the guiding principle is to create express lane stretches at least two miles long. The concept is to limit ingress/egress for the HOT facility to locations separated by about two miles similar to the HOV access limitations in southern California's freeways, a proven operational design.

b. **HOT-2 with Dynamic Value Pricing —** The MAG Region currently only has two-person carpool facilities. In the near-term, this should be preserved to minimize confusion and maximize usage. Therefore, the guiding principle is to implement "HOT-2" facilities. This designation is used to denote that two-person carpools travel for free (without the need for transponders) and that usage fees (e.g., tolls on a per trip basis) will be charged for solo drivers who have electronic toll transponders installed on their vehicles and have valid toll patron accounts. Furthermore, to ensure ample mobility for HOV users, as well as for toll payers, the guiding principle is to set tolls sufficiently high to maintain an adequate level of service (LOS) to ensure travel time savings. Assuming the general-purpose lanes are at LOS E or F, maintaining LOS D or better in the HOT lanes will provide at least a 25 mph speed differential between the HOT and general-purpose lanes. LOS D in a two-lane HOT facility would permit a vehicle density of about 1800 vehicles per lane per hour (v/l/hr) and in a one-lane HOT facility would allow about 1500 v/l/hr. Experience with the I-15 Express Lanes dynamic pricing in San Diego has shown that dynamic value pricing is operationally viable and can be cost-effectively implemented.

Figure 2-12
Design Concept for Limited Intermediate Access for HOT Lanes



c. **Toll Revenue Usage** — Based upon the December 1999 public opinion survey conducted for this study, as well as other surveys and studies throughout the United States, toll revenues should be used for construction (as needed), operation and maintenance of the HOT lanes. Any remaining net revenues should be applied to transportation improvements (highway or transit) in the corridor or the adjacent areas.

d. **Mobility Options for SOVs** — The other guiding principle for the HOT lanes is to provide clear mobility options for single occupancy vehicles (SOVs) who are willing to pay. By maintaining at least LOS D (hence, at least a 25 mph speed differential relative to LOS E/F in general purpose lanes) via dynamic value pricing for SOVs, the "value" to those solo drivers who need to save time and/or arrive on time at their destination is maintained. Thus, "valuable" mobility options are provided to SOVs who wish to use the excess capacity in the HOT lanes. Variable message signing will be needed to inform the toll-paying SOV of the fee to allow an informed choice.

e. **Violation Enforcement —** To maintain the integrity of the HOV facility, carpool violation enforcement needs to be increased for Value Lanes. Allowing SOVs (albeit with valid toll payment transponders conspicuously displayed) into the carpool lanes can create opportunities for motorist abuse. Both the SR-91 and I-15 Express Lanes in California have invested in vigorous enforcement of carpool violations by hiring the California Highway Patrol to provide extra enforcement during peak periods as an operating expense. Observations of the I-15 Express Lanes have shown that one of the side benefits of increased California Highway Patrol enforcement funded by the operators is that illegal SOVs ("scofflaws") were reduced to between three and five percent of Value Lane traffic. This compares very favorably to violation rates on California HOV lanes (which generally range between five and ten percent of HOV traffic, but can be as much as 15 to 20% without enforcement). To that end, another guiding principle for HOT lanes in the MAG Region is to enforce carpool violations using Department of Public Safety (DPS) to limit violation rates to no more than 5-10%.

Criteria for HOT Lanes Implementation

Based upon these guiding principles, the criteria used for assessments of Value Lanes implementation used for this study were as follows:

- **HOV lanes are under capacity.** For one-lane facilities, available HOV capacity threshold is deemed to be less than 1,400 vplph (not including scofflaws). For two-lane facilities, capacity is considered to be 1,600 vplph. Hence, if the HOV volumes are <u>under</u> these capacity levels, then the HOV facility is under-utilized and HOT lanes could be potentially implemented. The concept is that to maintain LOS D or better, the traffic volumes need to be sufficiently low and the maximum operating capacity should allow a 100 vplph cushion for the value pricing strategies. Recall, the maximum HOV lane capacities for single and two lane facilities are 1,500 vplph and 1,700 vplph, respectively.

- **General-purpose lanes are at (or near) capacity.** Congestion in the general-purpose, free lanes is needed for HOT lanes to have "value." Without congestion approaching LOS E or F in the general-purpose lanes, there would be no demand for Value Lanes.

- **HOT Lanes should be able to self-fund implementation and operation**
  The revenue from HOT lanes on a corridor should be sufficient to fund the implementation and operation of the HOT lanes (as well as potentially be sufficient to obtain toll bonds for construction of the lanes, if other funds are not available). Thus, positive net revenues (after operations and maintenance expenses) are needed if the HOT lanes are to be fiscally viable. The net revenues also need to be sufficiently large to self-fund the construction.

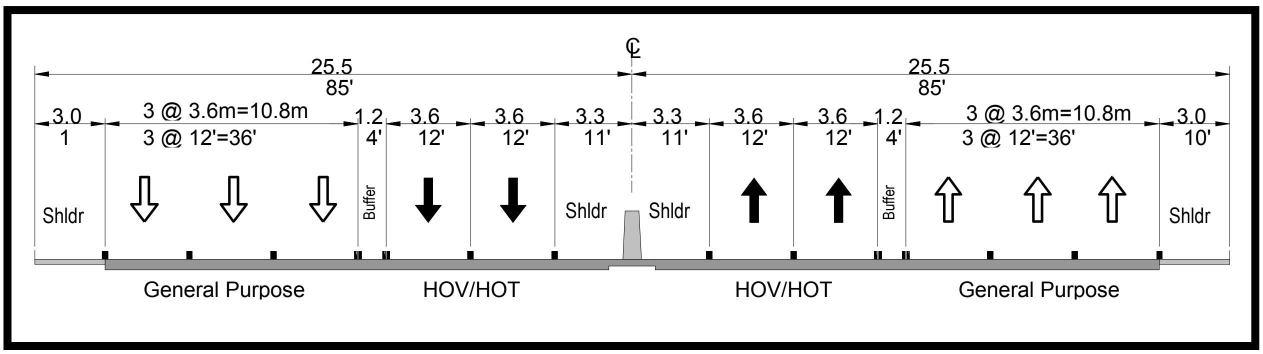
Note: All criteria are subject to public support and official governmental approvals, as needed.

2.4.3 HOT Lane Design Concepts

The Value Lane design concepts that were used for this feasibility study follow the above principles. The infrastructure design concepts are the primary focus, since they must be accommodated in the lanes.

Cross-section — A typical two-lane HOT lane cross-section is shown in Figure 2-13. This cross-section is based upon highway design standards for HOV lanes and design recommendations to achieve the goals and principles being defined here. The center median is shown with an inside 11-foot shoulder, recommended for motorist breakdown. Where space is not available, a three-foot shoulder could be acceptable, though not preferred. Also, assuming space is available, the recommended typical cross-section contains a four-foot buffer between the general-purpose and Value Lanes (for paint and the fixed pavement delineators shown in Figure 2-12). The preferred buffer would be a concrete barrier, although this has higher costs and requires a larger section. The design concept shown here (e.g., paint and delineators) was the basis for this feasibility study. However, the actual design will vary, since these and other design trade-offs exist for each road segment.

Figure 2-13
Design Typical for HOT lanes Cross-Section for Two-Lane Facility



The cross-section for a one-lane facility is similar to that shown in Figure 2-13 except that one of the HOV/HOT Lanes would be eliminated in each direction.

Toll Collection and HOV Verification Zones — An artist's concept for the toll collection zones (needed for each segment of the Value Lane, between each ingress/egress area) is illustrated in Figure 2-14. This illustration shows a two-lane facility with electronic toll collection antenna suspended over the lanes in the collection zone, aligned with an observation booth for HOV verification. In this diagram, the toll payers would drive in either lane and the carpools would only be allowed in the second lane from the median. There are many variants of this concept; the diagram serves to illustrate one of these variations. This design approach is similar to that used on the I-15 Express Lanes in San Diego (shown in Figure 2-15).

Figure 2-14
Concept Design for Toll Collection and HOV Verification Zone

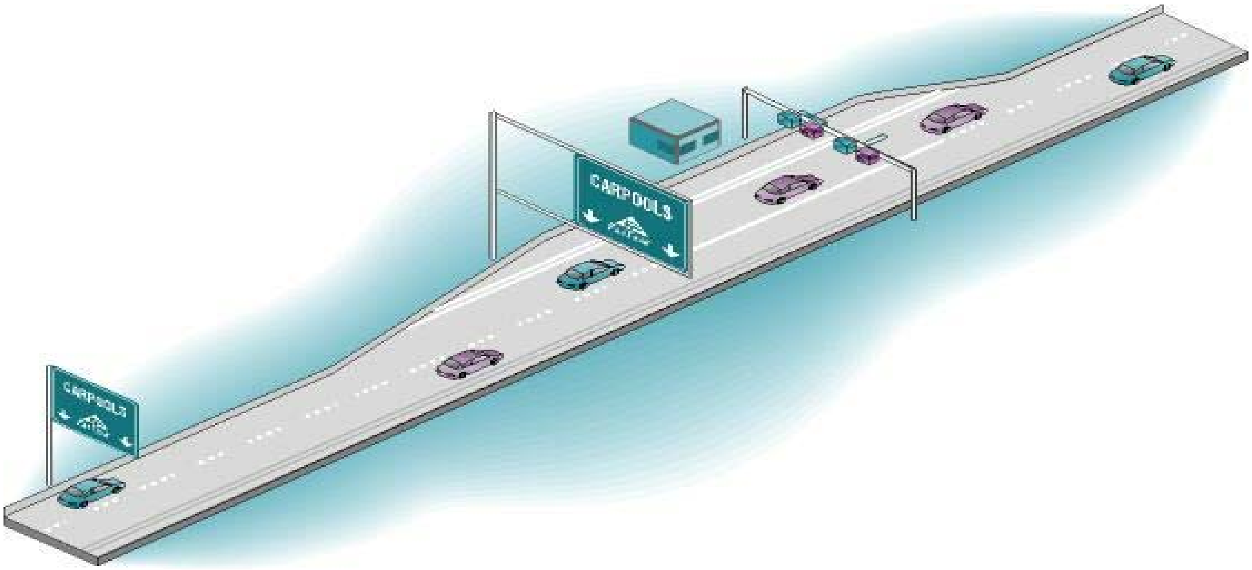


Figure 2-15
I-15 Express Lanes Toll Collection and HOV Verification Zone

Where space is available, the recommended toll collection zone would have a third lane for HOV verification similar to that used on the 91 Express Lanes (see Figure 2-8 for this configuration). The HOV verification turnout lane design concept is shown in Figure 2-16. This drawing shows how the third (turnout) lane could be “borrowed” from the center median’s inside shoulders, if available.

HOV Enforcement Areas — Following the guiding principles regarding increased enforcement of carpool lane violations, the Value Lane design concept allows for HOV verification, as described and illustrated above, as well as areas for DPS to enforce the HOV violations. The preferred area would be similar to that included in the 91 Express Lanes design, which has an expansive zone for enforcement vehicles, as shown in Figure 2-17.

Figure 2-16
HOV Verification Turnout Lane Design Concept

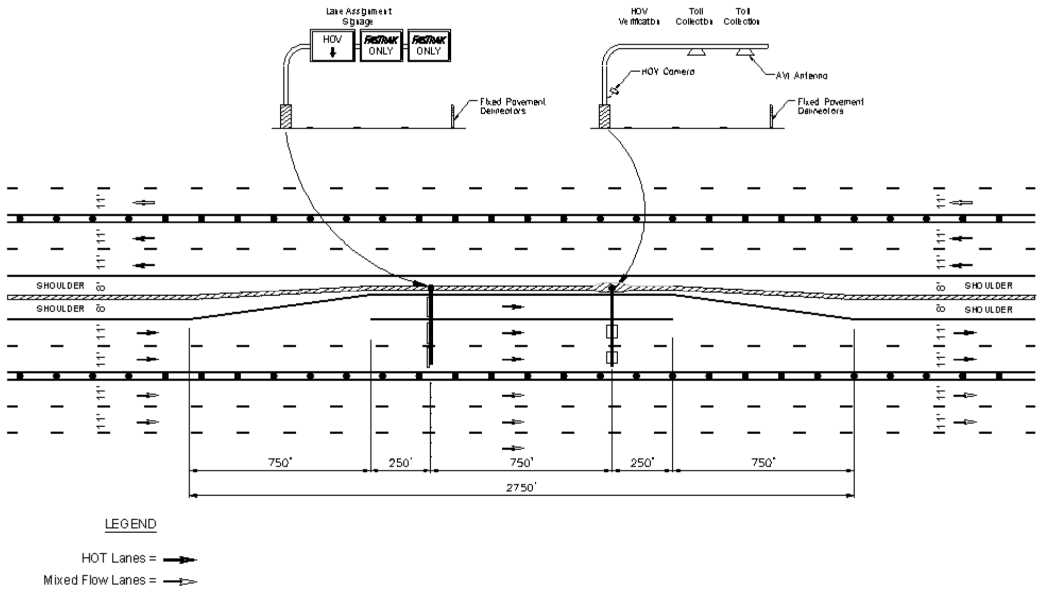
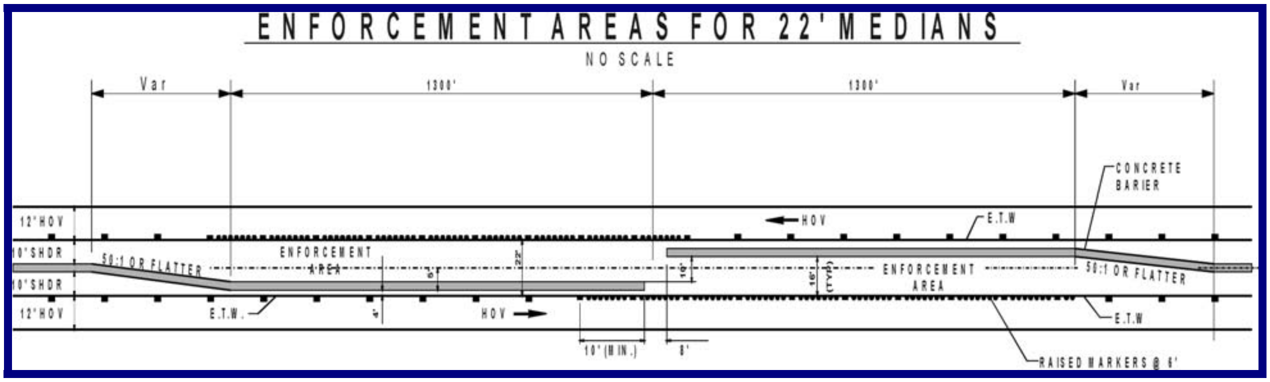


Figure 2-17
HOV Enforcement Areas in 91 Express Lanes

It is more likely that the enforcement area for the MAG Region's Value Lanes would be much smaller, due to the lack of such expansive shoulders. The most likely design is to use areas "borrowed" from the center median's inside shoulders, allowing DPS motorcycle officers to position themselves in the center median adjacent to HOV lanes. The DPS motorcycle enforcement areas design concept is shown in Figure 2-18. This design is that used for HOV enforcement areas included in California's carpool lane design manual.

Figure 2-18
Design Concept for HOV Enforcement Areas for DPS Motorcyclists

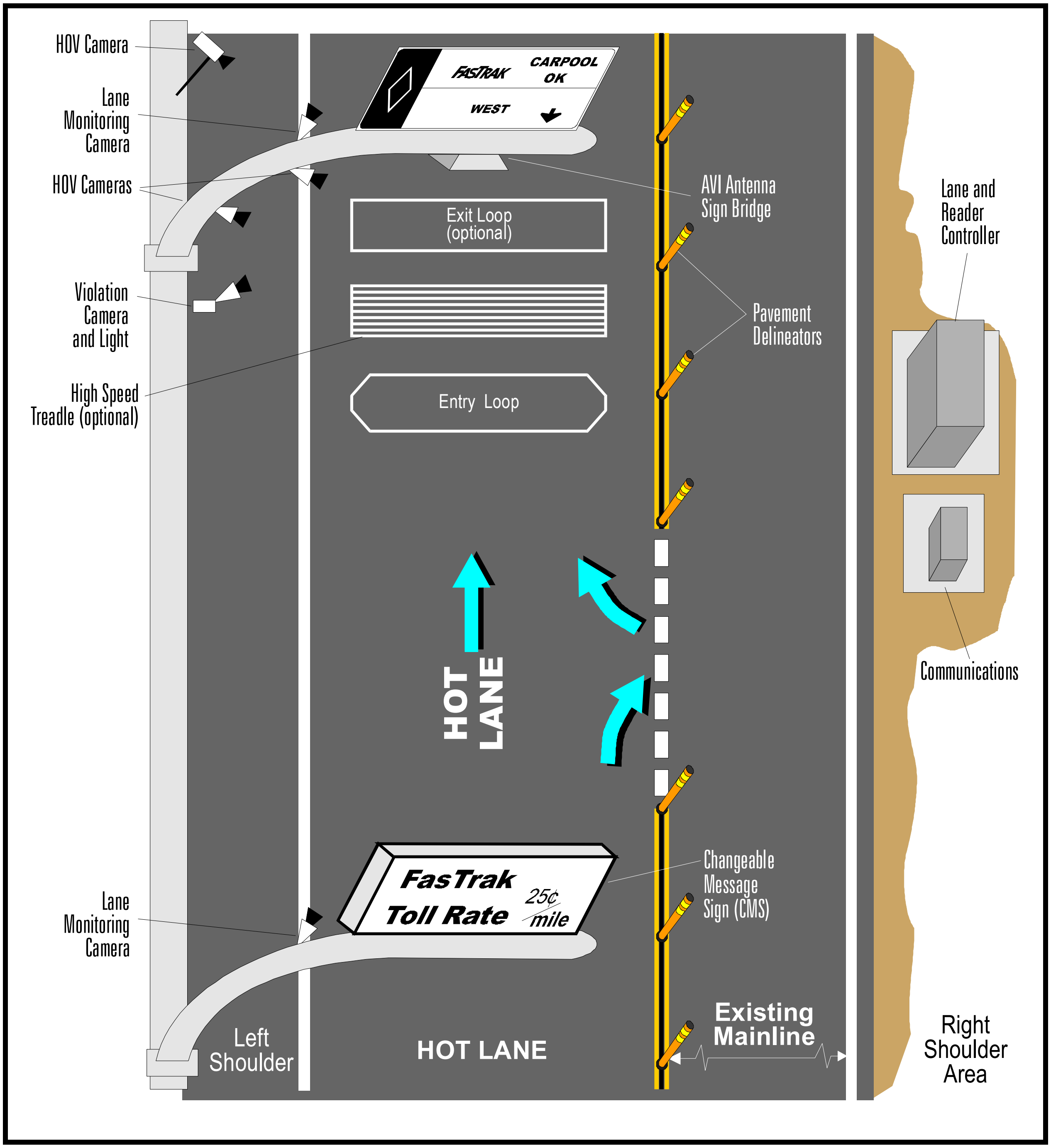


Toll Collection System and Equipment — An electronic toll collection (ETC) system and equipment is needed to operate the Value Lanes. The typical configuration for a one-lane facility is shown in the diagram in Figure 2-19.

On-site Equipment — The diagram in Figure 2-19 shows the on-site equipment that would be in-lane and on the roadside. The Automatic Vehicle Identification (AVI) antenna is suspended over the lane to read the transponder on each toll-paying vehicle. The AVI antenna communicates with an on-site AVI reader, shown here as contained in a roadside enclosure. The toll collection system components must also include an on-site processor (usually referred to as the Lane Controller) to interface with the AVI reader and all other in-lane sensors, as well as to process, store and forward transaction data to the back room computer system.

Other on-site equipment may include vehicle detection sensors, including induction loops, high speed treadles (e.g., axle counters), and vehicle separators (e.g., light curtains) to provide automatic vehicle detection and classification. Also, video cameras, lighting, digitizers, and data processors would provide digital video images of violators' vehicle license plates. Optical character readers would automatically read the license plate imagery. Closed circuit television (CCTV) surveillance cameras would assist HOV spotters and provide communications on transaction information and video images to the DPS vehicle stationed in enforcement areas for manual real-time violation enforcement. They would further record transaction data and images for court verification purposes; etc. The on-site equipment would also include communications equipment in a cabinet, uninterruptible power supplies (UPS) in the lane enclosure cabinet, and possibly backup power generators on slabs. The latter items would be on the right shoulder area. The ETC system must include the necessary information regarding safety, security, environmental protection, redundancy, installation, warranty, training and documentation.

Figure 2-19
HOT Lane Electronic Toll Collection (ETC) System Typical Configuration



Infrastructure — Lane infrastructure must include overhead structures for the AVI readers, NEMA cabinets and pedestals for the Lane Controller/AVI Reader Controller and the communications equipment, as well as access to power and communications lines at the roadside. Toll transactions and video surveillance data communications can easily be transmitted through telephone lines or the equivalent. Power is needed to operate the on-site electronic equipment. Data and power conduits from the right hand roadside enclosures to the in-lane equipment (cameras, AVI antenna, etc., as illustrated in Figure 2-19) are also necessary. Finally, variable message signs (VMS) are also recommended to inform the motorists of the value pricing. The large overhead signs shown in our diagram in Figure 2-19 and in the photograph of one of the 91 Express Lanes VMS's in Figure 2-20 are certainly preferred, although these can cost as much as the rest of the ETC on-site equipment. An acceptable, smaller VMS used on the I-15 Express Lanes is shown in Figure 2-21.

Figure 2-20
Large Variable Message Sign on 91 Express Lanes Provides Advertising as well as Informing Motorists of Toll Rates.

Figure 2-21
Smaller Variable Signage on I-15 Express Lanes Shows Variable Toll Rates

Back Room — The Host, off-line violation image processing and enforcement, as well as the Customer Service Center functions, are also components of the toll collection system needed for the Value Lanes. If these back room functions are provided by an existing toll system (e.g., in California: 91 Express Lanes, I-15 Express Lanes, TCA's toll roads or Caltrans' toll bridges; or in Denver: E-470 Public Highway Authority), then the incremental equipment would be communications data lines. Under this scenario, the only additional facilities needed would be for added retail outlets for Customer Service Centers at selected locations in the MAG region. If these back room functions are dedicated and standalone for the MAG Region's Value Lanes, then the back room processing would need a standard office facility with computer and communications equipment. It would need office space for the finance, violation processing, and Customer Service Center personnel. In addition, the software needed to perform these functions would need to be acquired from a toll system integrator.

2.4.4 HOT Lanes Operating Concepts

For this feasibility study, a set of HOT lanes operational concepts were developed to be used for the fiscal evaluation. These are summarized in Table 2-2, where each area of operation is shown, along with the selected operating concept and the rationale for each selection.

Table 2-2
HOT lanes Operating Concepts
Selected for Feasibility Evaluation

POLICY	ASSUMPTION	RATIONALE
Hours of Operation	▪ 24 hours for New HOT lanes	▪ Smoother operation, less confusion
	▪ Peak periods for Conversions	▪ Expect better acceptance from public
Access Eligibility	▪ Carpools: HOV 2 without transponders ▪ Vehicle types allowed same as HOV	▪ Maintain status quo for carpool definition
Physical Access	▪ Separation of HOT Lanes with intermediate ingress/egress points	▪ Operational Safety concerns
Verification of HOV User and/or Toll Violators	▪ Where viable, use Verification Lanes in Enforcement Areas ▪ Augment with Cameras monitored by DPS	▪ Limits motorist abuse and allows HOV and Toll Violation Enforcement by DPS and Operator
Toll Rates	▪ Value/Congestion Pricing to maintain LOS D or better in HOT lanes	▪ Value Pricing allows travel demand management ▪ LOS D allows 20-30 mph difference
Operations & Maintenance	▪ Operator could be Private Firm (as Contractor or as Owner/Operator) ▪ Toll equipment by Operator ▪ Road maintenance by ADOT	▪ Allows potential public-private partnership ▪ Expertise most likely with Operator ▪ Maintenance costs and economies of scale
Security	▪ Ensure security via access controls ▪ Maintain privacy by protecting patron and violator account data	▪ Matches practices and processes adopted by electronic toll operators nation-wide ▪ Technology provides security and privacy

Hours of Operation — Since most of the existing carpool lanes operate only during peak periods in the MAG Region, the initial operating concept for HOT lanes created by converting existing HOV lanes is to only operate during peak periods, at least initially. However, if the facility opens as a HOT lane facility, then the policy should be to operate 24 hours each day as a HOT lane. This will allow smoother operation and be less confusing to motorists. In addition, the off-peak toll revenues, although smaller than those during peak periods, allow added income for little added costs, since the automated ETC systems do not require added staff to conduct off-peak operations.

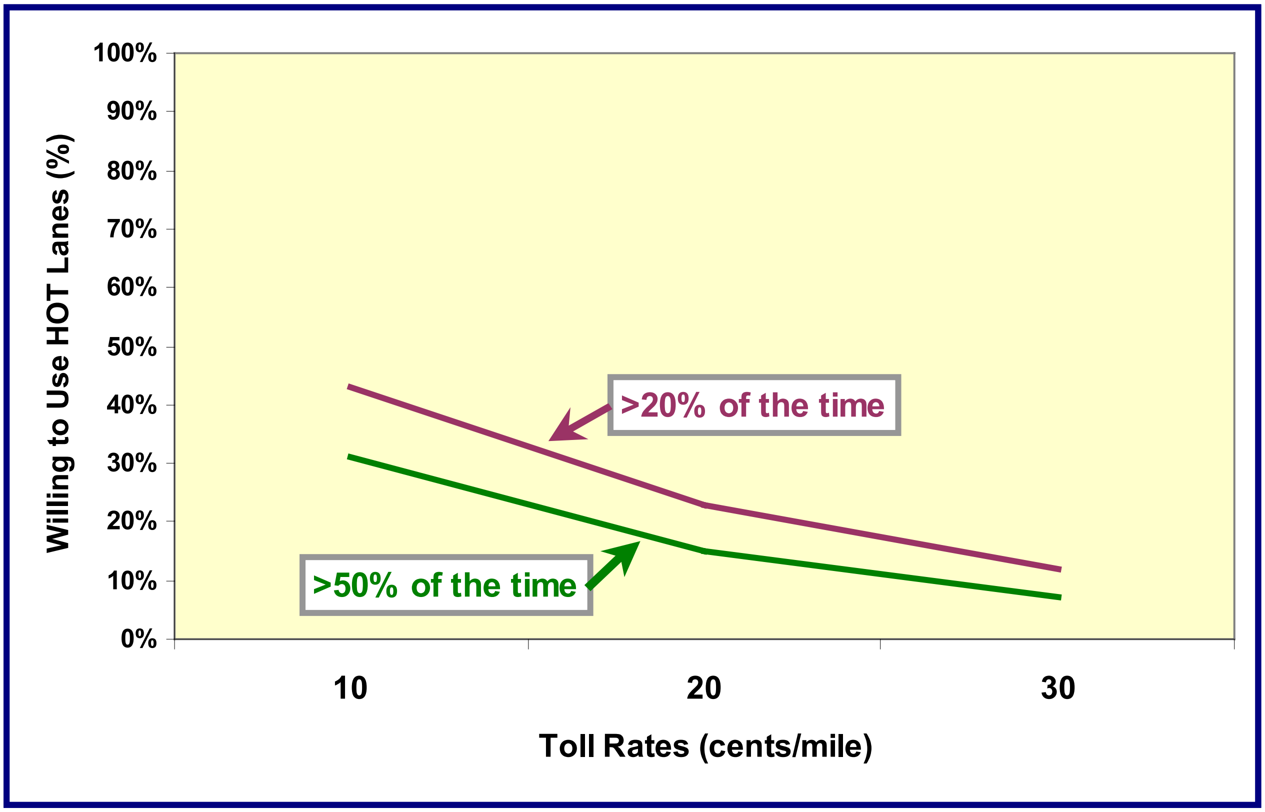
Access — The HOT access operating policy would be to allow eligible carpool vehicles (i.e., HOV-2) to enter without transponders. The vehicle types having access to the HOT lanes without transponders with valid accounts would be those currently allowed in HOV lanes. Solo drivers would be allowed to access the facility if they have transponders and valid pre-paid accounts. All others would either be HOV violators (traffic code) or toll violators (civil or traffic code), depending upon the definitions established by the HOT lanes enabling legislation (see Section 11.2 for further discussions regarding regulatory requirements). In addition, as previously discussed, to alleviate the operational safety concerns raised by the potential traffic weaving (to avoid tolls and/or violation detection), the HOT lanes would have limited ingress/egress points with buffer/barrier separation from the general-purpose lanes.

Verification — Wherever space and funding permits, the operating concept is to use an additional turnout lane (e.g., a second lane in one-lane facilities, a third lane in two-lane facilities) for HOV and/or toll violation enforcement. The motorists would need to sort into their appropriate lane, either HOV or toll-payer, which would simplify verification and permit automated toll violation enforcement by license plate capture camera systems. These verification lane configurations will enhance vehicle throughput, reduce scofflaw traffic, and increase revenues. However, they require about 0.8-mile segments for the added turnout lane and this right of way may not be available. Instead of observation booths, which are part of the 91 and I-15 Express Lanes' design but require DPS access, the operating concept is to use CCTV cameras in the verification lanes that would be routed to conveniently-located DPS officers. This concept is illustrated in Figure 2-19 by the "camera farm" attached to the overhead pole and structure that supports the AVI antenna.

Toll Rates — Dynamic Value Pricing that maintains LOS D or better in the HOT lanes was selected for this study since it provides added insurance that traffic flow can be maintained in the HOT lanes. By insuring a travel time saving (versus the adjacent general-purpose lanes) for both the carpools and the toll-payers, the Value Lane goals can be met. The FHWA-sponsored Value Pricing Pilot Project on the I-15 in San Diego has clearly demonstrated the feasibility and desirability of using dynamic pricing for travel demand management. Based upon the survey results and other toll strategies around the nation, the tolls would be between $0.10 and $0.40 per mile with a minimum of about $0.75 per trip. For example, a six-mile trip would cost between $0.75 and $2.40, depending upon the congestion levels in the Value Lanes and adjacent general-purpose lanes. The toll rates would be set dynamically for each corridor in each direction to maintain LOS at D or better. The MAG Region survey results in Figure 2-22, conducted for this study, illustrate the toll pricing strategy discussed here. Effectively, increasing the toll rates reduces the percentage of those willing to pay. The actual price elasticity will be determined empirically, but that shown in the figure is typical for U.S. cities.

Operations and Maintenance — The concept for Operations and Maintenance is that it could be performed by a private firm either acting as a contractor for a public agency or as an owner/operator under a franchise agreement with the public agencies. This will allow potential public-private partnerships for implementation and/or operation of the Value Lanes. The maintenance of the toll system and equipment should be the responsibility of the operator, due to the expertise most likely to be with the operator. However, the maintenance of the roadway should be performed by ADOT, due to the expertise, equipment and economies of scale available to the Department.

Figure 2-22
Toll Rates and Willingness to Use HOT Lanes (from Maricopa County Public Opinion Poll conducted in December 1999 for this study)



Security — Security of patron account information needs to be ensured. This can be accomplished using practices and processes adopted by electronic toll operators nationwide. Available technology provides the necessary security to protect the privacy of toll patrons and violator account information in the systems' data banks. The toll transaction data coming from the on-site toll collection zone is limited to transponder identification numbers and violator license plate images. The valid transponder identification numbers are all that need be transmitted to the lanes. Patron or violator account data does not need to be distributed outside of protected databases at the back room electronic toll collection computer data center.

SECTION 3: PUBLIC INVOLVEMENT

3.1 PURPOSE

Public opinion and attitudes regarding the concept of Value Lanes (e.g., HOT Lanes with Value Pricing) are critical to the serious consideration of Value Lanes as an alternative to address transportation issues in an urban environment. Additionally, the general public, private business, and public agencies need to be aware that Value Lanes are being considered as part of an overall solution to address transportation mobility in the region and that a study effort is underway to address their potential. The public involvement component included methods to obtain objective opinions and attitudes from the public related to Value Lanes and carpool lanes, as well as to inform stakeholders and the public about the study efforts and results at critical points in the process. The primary methods used were a public opinion survey and two focus groups.

The public involvement component was also designed to be consistent with provisions of the Transportation Equity Act for the 21st Century (TEA 21), the Maricopa Association of Governments' *"MAG Process for Public Involvement in Transportation Planning"*, as well as other local, regional, and state agency policies that seek to involve the public in the decision-making process.

The public involvement process was created to engage the general public, community and special interest groups, agency representatives, and policy leaders in meaningful and collaborative discussions regarding the feasibility of instituting Value Lanes on the freeway system in the Phoenix metropolitan area. All of these parties have an interest in, and may be affected by, the establishment of Value Lanes and their supporting policies.

3.2 PUBLIC INVOLVEMENT GOALS AND OBJECTIVES

Any successful public involvement process necessitates the establishment of goals early in the process and the formulation of objectives to achieve the desired goals. The specific program for public involvement is then built with the intention of meeting those goals and objectives. The goals and objectives for the ADOT/MAG Value Lane Study were developed based on known issues and concerns within the study area and are consistent with the strategies recommended by the Federal Transit Administration and the Federal Highway Administration in the publication *Public Involvement Techniques for Transportation Decision-Making* (September 1996).

The three goals and the objectives developed to meet each goal are described as follows:

Goal 1: Obtain objective and reliable opinions and attitudes from the public on the concept of Value Lanes and carpool lanes.

Objectives:

- Develop methods to obtain reliable opinions and attitudes from the public regarding Value Lanes.

- Develop methods for effective incorporation of public opinions and attitudes in the study process to ensure that any Value Lane project brought forward from this study process has considered these opinions and attitudes.

Goal 2: Inform and educate the public and agencies of study efforts.

Objectives:

- Provide information to the general public, local and regional transportation agencies, and affected cities' staff about the study at major milestones, or decision points, during the study.
- Engage and educate the public and the agencies in the study process and inform them of the importance of their attitudes and opinions in determining the outcome.
- Develop and implement a formal process for enabling the public and agencies to provide input during the study process, including the development of alternative strategies, identification of trade-offs, and methods for evaluating and selecting a preferred strategy.

Goal 3: Build understanding among competing interests.

Objectives:

- Present study findings and alternatives in an understandable, objective, and reader-friendly manner, focusing on how the alternatives differ in meeting the mobility and accessibility needs of the study area.
- Facilitate discussions among stakeholders so that they can participate in constructive debate about the ability of alternative strategies to meet the real and perceived transportation needs in the study area.
- Formalize a process to incorporate public and agency input into the technical analyses performed during the study, and be able to demonstrate to the community that their issues and concerns have been addressed in the most appropriate manner.

3.3 PUBLIC INVOLVEMENT PROCESS

The public involvement process for the Value Lane Study targeted two groups from which input was sought in the planning process. The two groups or "target audiences" are:

- Citizens (general public); and
- Stakeholders.

Because of their diverse needs, concerns, and interests, a tailored approach was developed for each group so that the attitudes and opinions of both were considered in the study process. Methods for outreach, education, and information were varied for each group.

General Public

This group represents the broad interests of the general public and is the most difficult to effectively engage in the planning process due to the size and diversity of the group. Interaction with this group requires that outreach methods and participation techniques be equally diverse.

Participation from the general public can be inconsistent and often depends on the topic of discussion and how it is perceived to affect them personally. Past experience has shown that interest levels become higher during the latter phases of the study during which potential strategies are better defined. However, it is critical to inform and involve the public at various stages in the process to develop a common base of understanding and to identify possible issues that could later delay the project during design and implementation.

The general public had several opportunities throughout the planning process to participate in the study and to be informed and provide input. The major effort to receive input from the general public was by conducting focus groups and a public opinion survey. Additional efforts to reach out to the public included:

- MAG open houses conducted over the course of the study. The findings of the Value Lane Study that corresponded to the timing of the open houses were presented at the events.

- Materials were developed for incorporation into news releases and for circulation to provide information if requested. The materials were available for inclusion in the MAGAZINE, a quarterly newsletter published by MAG, and on the two web sites maintained by MAG and ADOT. The newsletters and websites provided a means for the public to provide input if they so desired.

Stakeholders

This group consisted of a mix of federal, state, and local agencies, as well as civic and business groups. Identified stakeholders included the MAG Transportation Review Committee, whose membership includes technical and policy staff from:

- MAG member agencies;
- ADOT; and
- Regional Public Transportation Authority.

Additional stakeholders included staff from the Federal Highway Administration, the Citizens Transportation Oversight Committee and the Governor's Vision 21 Task Force.

These stakeholders were notified a number of times throughout the study period and informed via briefings, both at the start and at the end of the study. Final recommendations were amended as a result of these interactions and special evaluations, including the alternative evaluation of HOV rankings in Appendix D.

3.4 PUBLIC OPINION SURVEY

A telephone poll was conducted between December 7th and 14th of 1999 of 500 adult licensed drivers in Maricopa County, Arizona, regarding their thoughts and opinions on about 30 various local transportation questions, including high occupancy vehicle (HOV) lanes and Value Lanes. The full report on the results of the public opinion survey is included in Appendix A, wherein part A1 provides the poll questions and results, and part A2 is an evaluation of those results.

The key public opinion poll results related to HOV lanes are as follows:

- 79 percent of those polled had heard of carpool lanes and had used them;
- 86 percent approved of the HOV lane concept, with 62 percent strongly approving the concept;
- 75 percent agreed that *more* HOV lanes should be built on the region's freeways;
- Daily commute lengths of those polled were:
    - 33 percent do not commute
    - 15 percent have a commute under 15 minutes
    - 23 percent have a commute between 15 and 29 minutes
    - 17 percent commute 30-44 minutes
    - 9 percent have a commute over 45 minutes
- 66 percent of those polled use HOV lanes sparingly (less than 20 percent of the time) or not at all.

The key public opinion poll results related to Value Lanes are as follows:

- Approximately 40 percent approved of the Value Lane concept upon initial explanation of the concept and 47 percent disapproved;
- Approximately 50 percent approved of the concept of dynamic Value Lane pricing after an extensive explanation;
- Approximately 80 percent approve of using toll revenues for freeway or transit improvements; and
- Willingness to pay tolls to save 15 minutes:
    - Over 50 percent of the time
        - 31% at $1.00
        - 15% at $2.00
        - 7% at $3.00
    - Over 20 percent of the time
        - 43% at $1.00
        - 23% at $2.00
        - 12% at $3.00

These toll rate results were previously presented in graphical form in Figure 2-21.

3.5 FOCUS GROUPS

Two focus group interviews were conducted. The first focus group was conducted on July 7th, 1999. The full summary of the focus group is included in this report as Appendix B. A local market research firm selected focus group members. The one condition that was common to all members of the group was that they use the existing freeway system in the Phoenix metropolitan area. A total of 12 people participated in the focus group (six male/six female). Most lived and worked in Phoenix. A few lived just outside the city, including Glendale and Mesa. Occupations included computer engineer, school teacher, retired, insurance sales, and housewife. The ages ranged from 29 to 66.

Highlights of the focus group included:

- Transportation issues were considered as serious among focus group members.
- Only one person had heard of congestion pricing.
- The majority of participants felt that HOV lanes are a sufficient incentive to carpool during rush hour.
- After viewing a video on congestion pricing, the negative comments about the concept outnumbered the positive comments.

The second focus group was conducted on April 5th, 2000. The full summary of the focus group is included in this report as Appendix C. A local market research firm selected participants. The one condition that was common to all members of the group was that they use the existing freeway system in the Phoenix metropolitan area at least 20 minutes per day. A total of 12 people participated in the focus group (eight male/four female). Eight participants lived in east valley cities, three were from west valley cities, and one participant lived in Phoenix. Seven participants were employed full time. The ages ranged from 33 to 71.

Some highlights of the second focus group included:

- When asked about the most challenging issue facing this area, one-half of the respondents responded with transportation. The issues of population growth and education were also cited.
- The public opinion poll conducted between the two focus groups found a high level of popularity for HOV lanes. The second focus group recruited people who used the freeways at least 20 minutes per day to determine their attitudes on HOV lanes. The second focus group confirmed the popularity of HOV lanes. When asked to respond to the statement, "HOV lanes are wasted space and should be opened up to everyone." -- 11 of 12 participants disagreed with the statement. When asked to respond to the statement, "If HOV lanes were opened to everyone, they would fill up and congestion would be the same or worse than it is today." -- 10 of 12 participants agreed.

- When asked to choose between various Value Lane name alternatives, the group participants viewed Express Lanes most favorably.

- In general, Value (or HOT) Lanes had limited support. However, after viewing a video produced by the Federal Highway Administration (i.e., *Saving Time*), some attitudes about Value Lanes became more positive.

SECTION 4: HOV LANES AND CONNECTORS RECOMMENDATIONS

4.1 Current and Planned HOV System

The currently adopted HOV System Plan of existing and planned HOV lanes is illustrated in Figure 4-1. Figure 4-2 depicts the same HOV System Plan with the addition of existing and planned HOV connectors and direct-access ramps. This HOV system reflects what is contained in the 1994 MAG HOV Plan. This adopted plan is the baseline for the HOV study. The adopted HOV system was evaluated to determine how well it will perform and whether enhancements could be made to further improve HOV system performance.

Current congestion levels being experienced on the freeways and HOV facilities are illustrated in Figures 4-3 and 4-4. Year 2010 and 2020 peak period and peak hour forecast volumes for the current and planned HOV system were provided by MAG for both the general-purpose lanes and the HOV lanes. Year 2020 congestion levels on the freeways and the planned HOV facilities are illustrated in Figures 4-5 and 4-6.

The following discussion summarizes the forecasted operating performance of the existing and adopted HOV System Plan. The results can be grouped into four general categories, as documented below.

4.1.1 HOV Operations

The facilities that will experience the highest HOV usage are the Squaw Peak, Black Canyon and Papago Freeway facilities. Year 2020 peak hour HOV lane volumes ranged from 1600 to 1700 vehicles on the above facilities. Typically, single lane HOV lanes have a capacity of from 1500 to 1800 peak hour vehicles. For this study, the single-lane HOV capacity was assumed to be 1500 peak hour vehicles (including scofflaws). Volumes above this level tend to erode the travel time advantage compared to the adjacent general-purpose lanes. Consequently, the year 2020 HOV volumes approach the capacity of the HOV facility, but do not exceed it. Year 2010 peak hour HOV lane volumes were approximately 20 percent less than the 2020 volumes, at 1300 to 1400 vehicles.

4.1.2 General Purpose Operations

The facilities that will experience the most traffic congestion in the general-purpose lanes include the Black Canyon, Papago, Squaw Peak and Superstition freeways. Traffic conditions were mostly at level of service (LOS) E and F in years 2010 and 2020 on the above facilities. The primary difference between the travel conditions for year 2010 and year 2020 were that more freeway segments were at LOS F in year 2020.

Figure 4-1
Planned HOV Lanes (from 1994 HOV Plan)

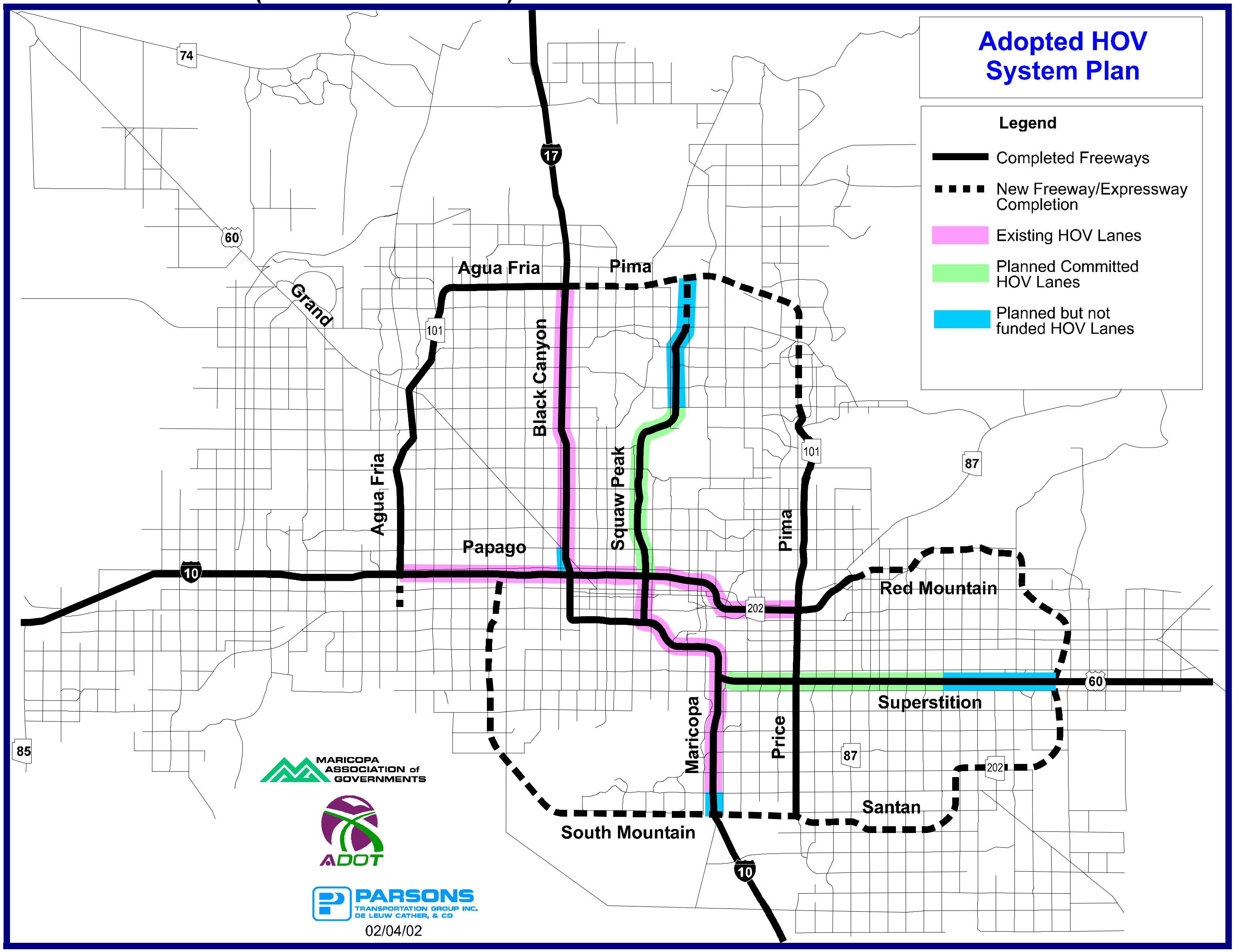


Figure 4-2
Planned HOV Lanes and HOV Connectors (from 1994 HOV Plan)

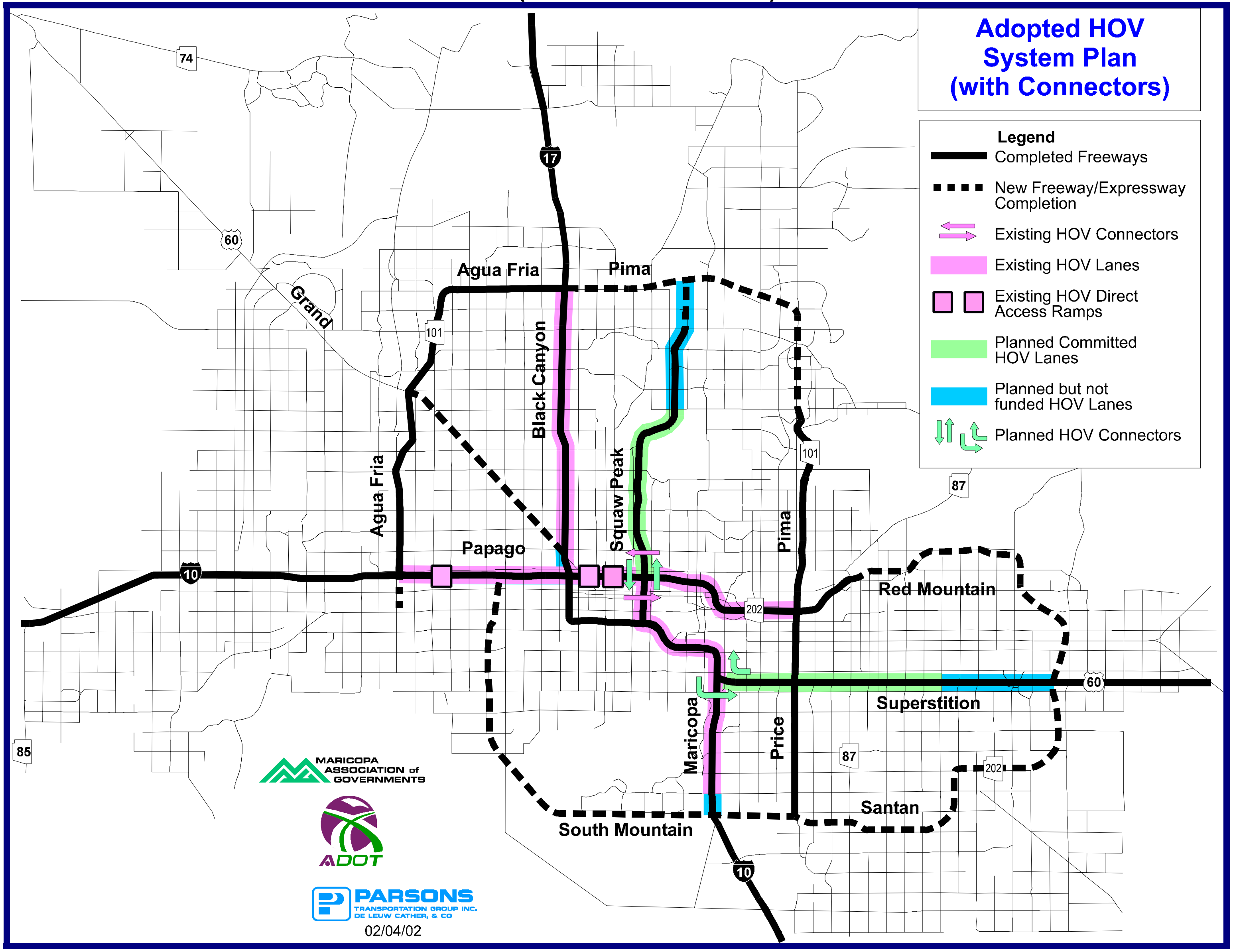


Figure 4-3
Base Case: 1998 Congestion Assessment LOS for Freeway Multiuse Lanes (AM Peak Period)

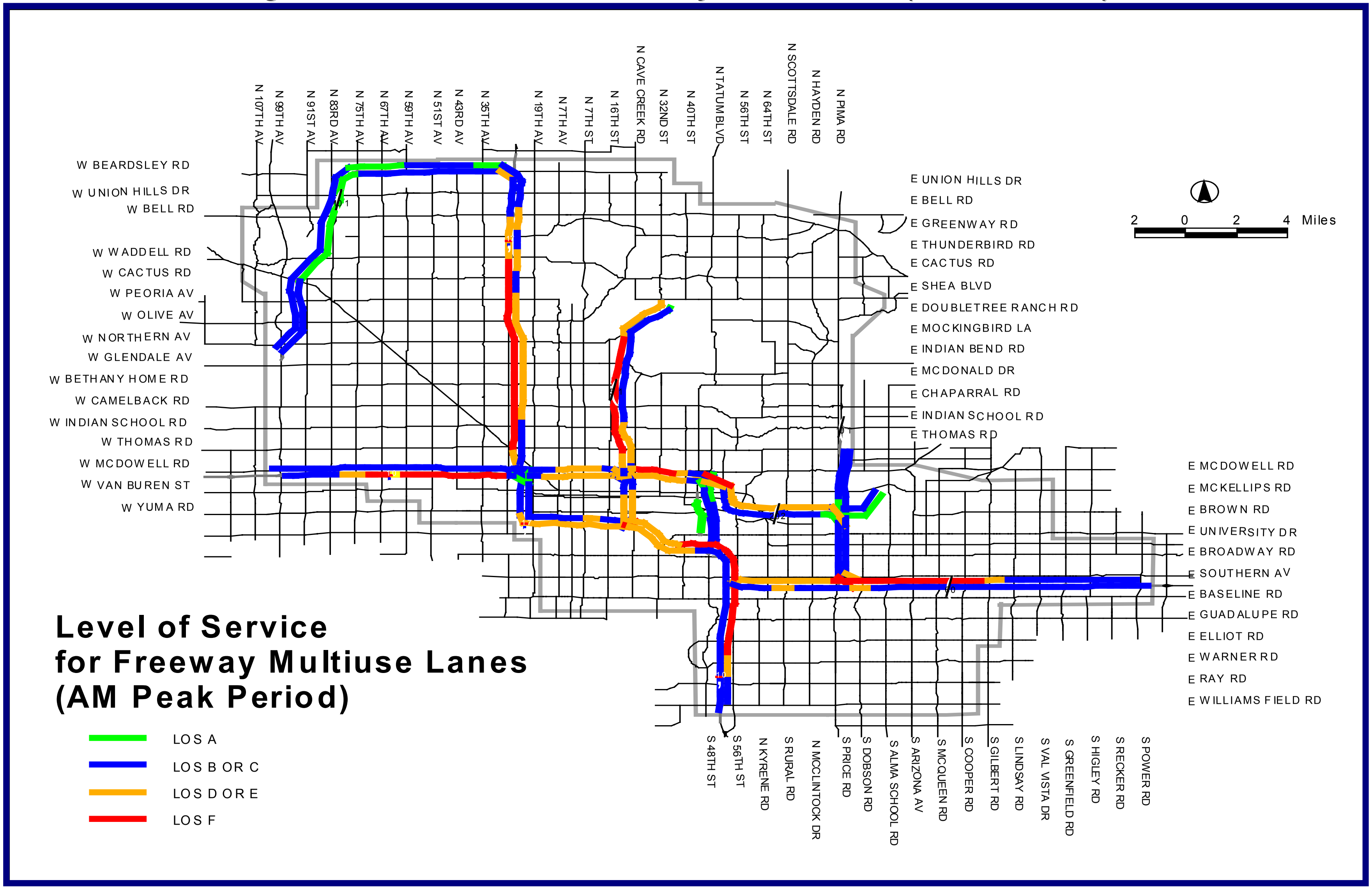


Figure 4-4
Base Case: 1998 Congestion Assessment LOS for HOV Lanes (AM Peak Period)

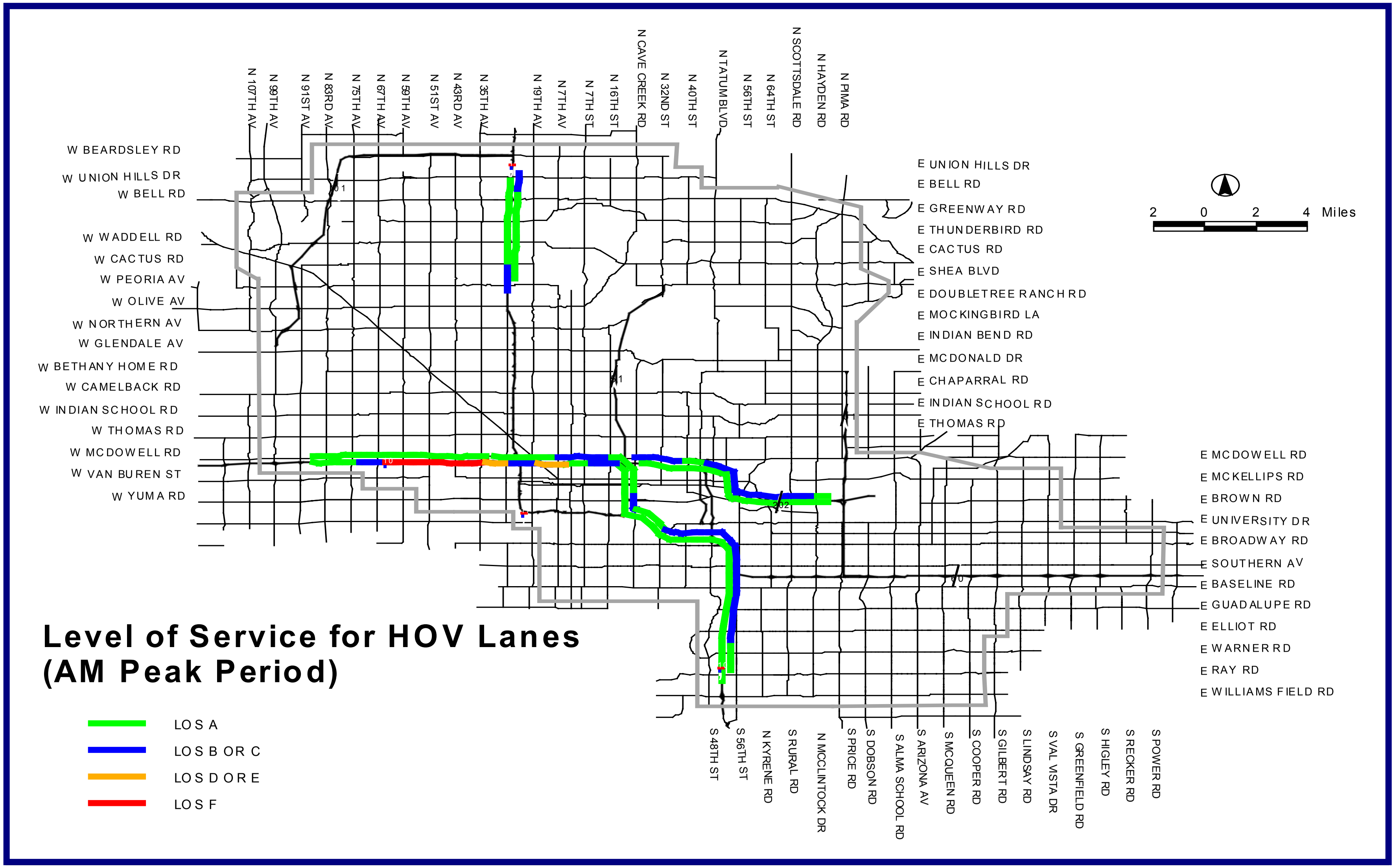


Figure 4-5
2020 Congestion AM Peak LOS in Freeway Multiuse Lanes

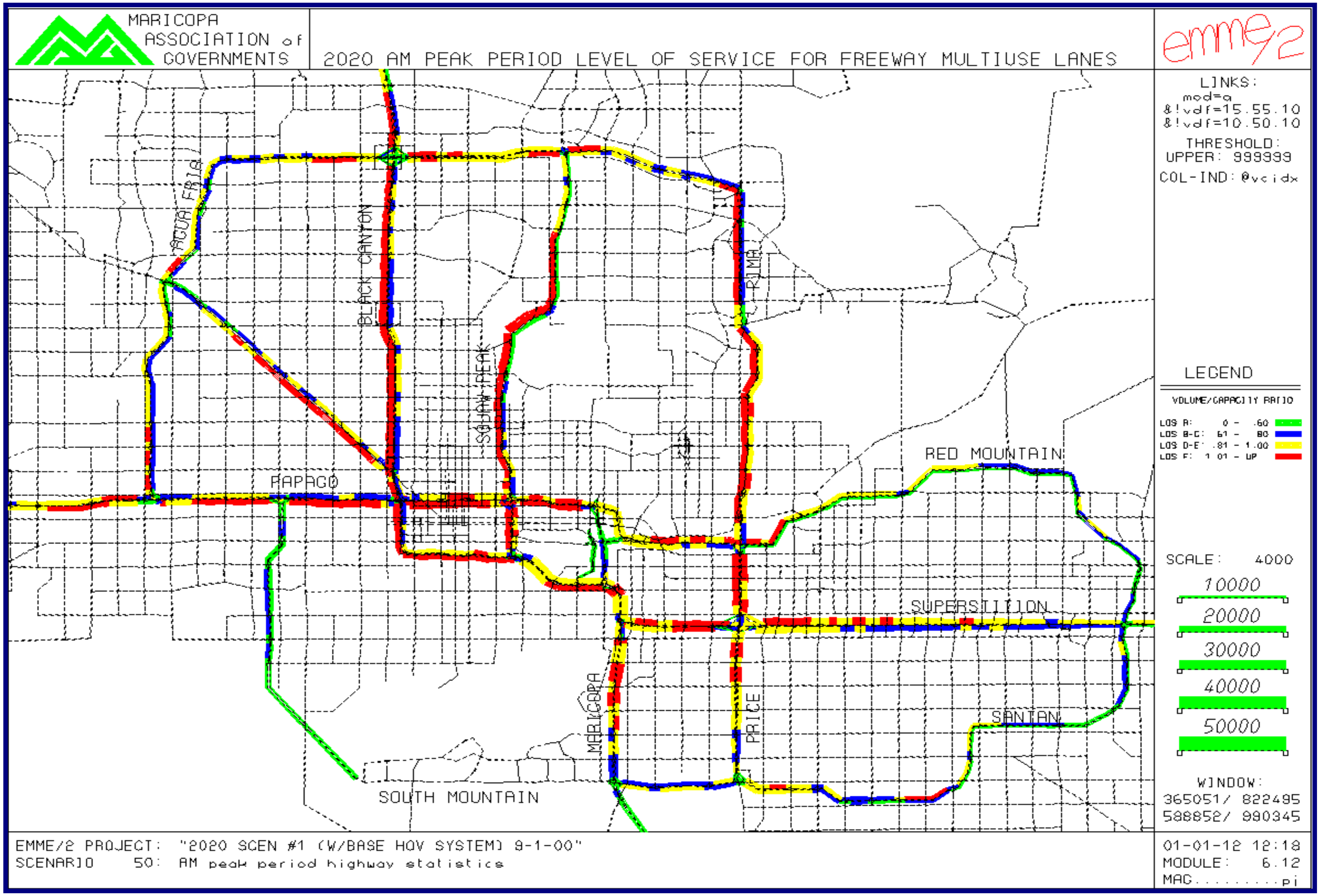
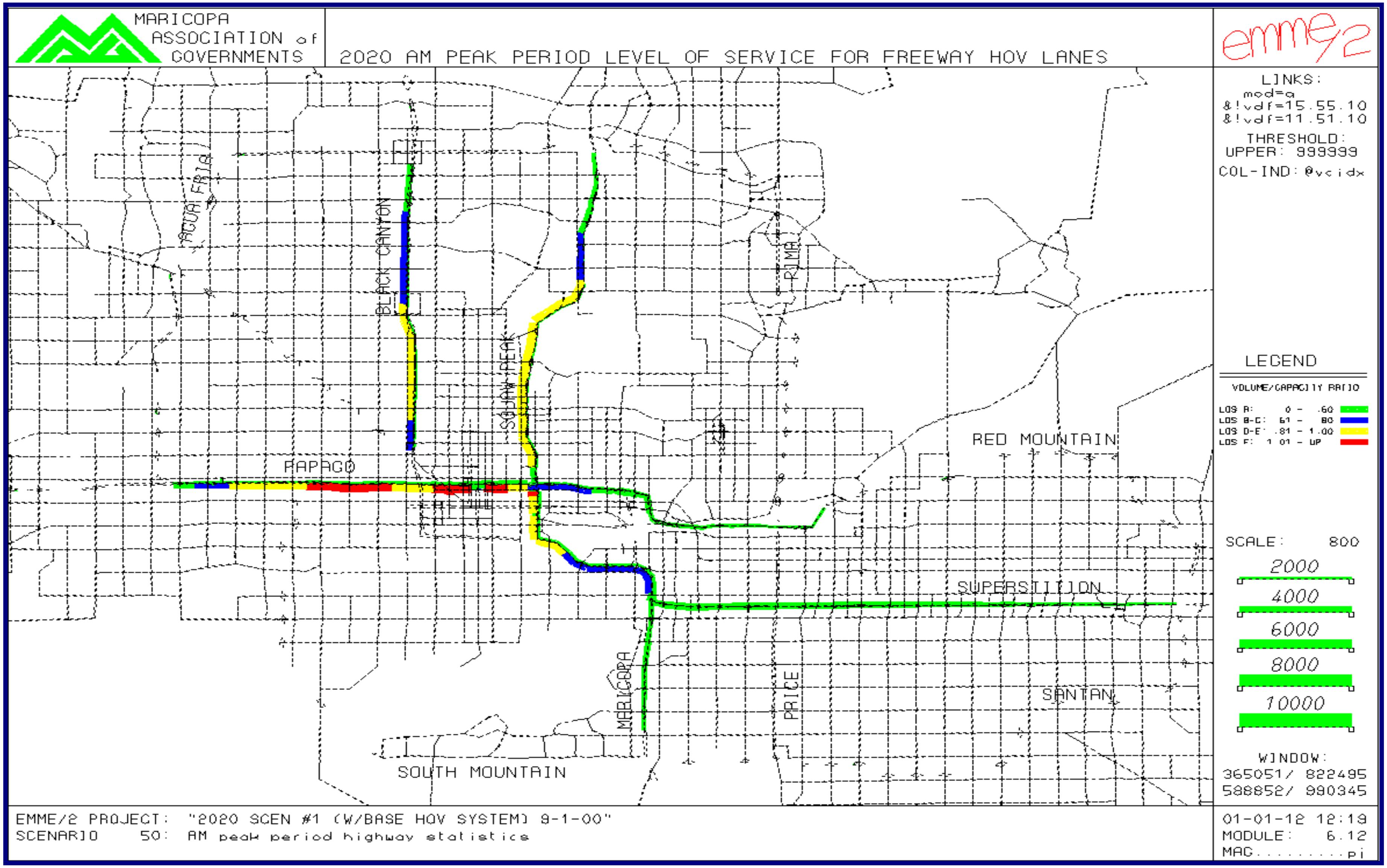


Figure 4-6
2020 Congestion AM Peak LOS in HOV Lanes



4.1.3 Peaking Characteristics

The model results forecast fairly high traffic volume occurring outside the traditional peak hours. Approximately 40 percent of the peak period HOV volume occur in the peak hour, while approximately 35 percent of the peak period general-purpose volume occur in the peak hour. The above information indicates that the peak hour/period will spread outside the traditional peak hour. It also indicates the HOV peak is more pronounced (i.e. more HOV traffic occurs in peak hour compared to the other hours within the peak period) than the general-purpose peak.

4.1.4 HOV Connectors

The existing and planned HOV connectors at the Papago/Squaw Peak and Maricopa/ Superstition interchanges are forecast to carry significant peak period HOV volumes and are appropriate to be included in the baseline HOV System.

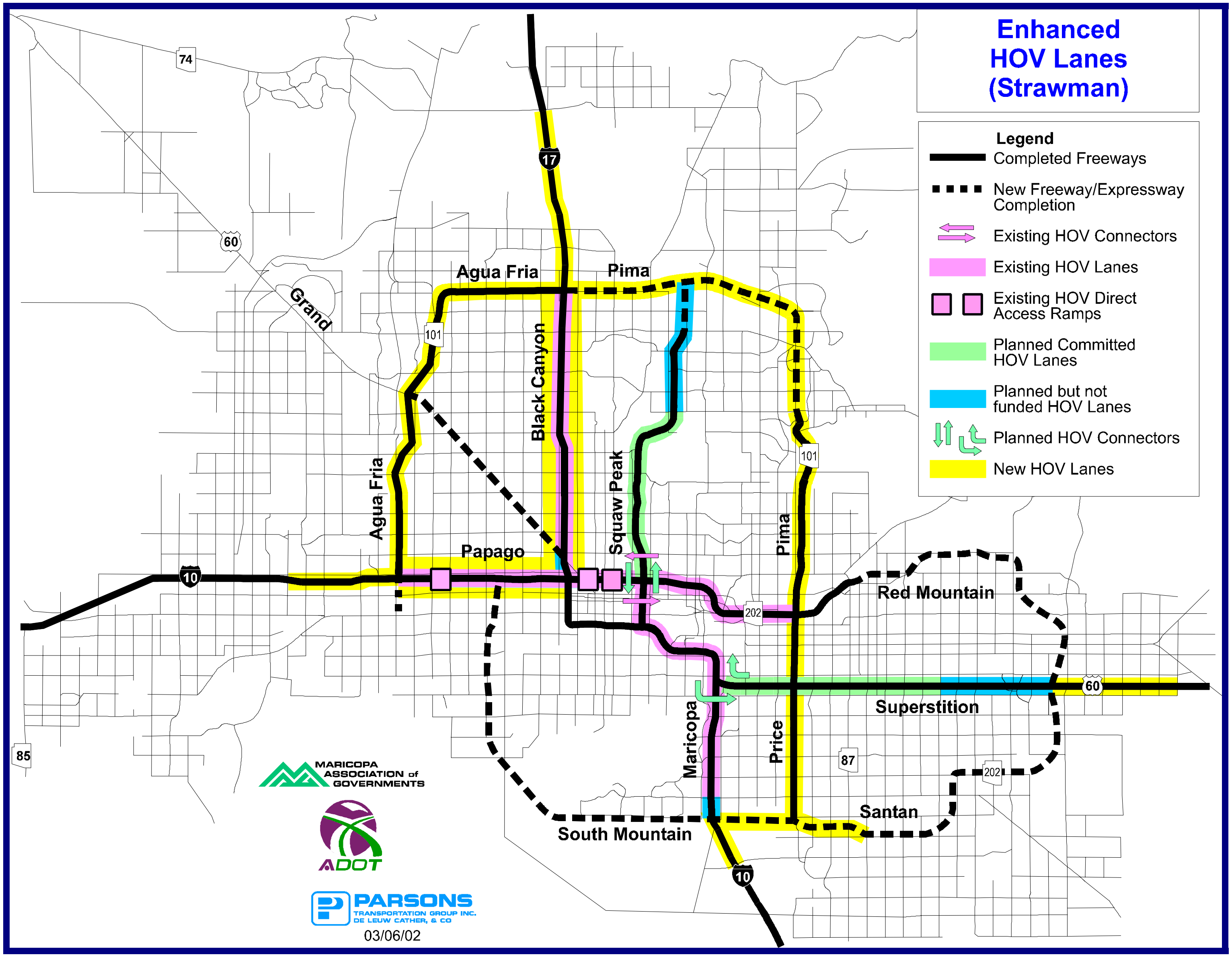
4.1.5 Findings

In summary, based on the MAG model results, the planned HOV system is well defined and accommodates a significant amount of HOV traffic. Additionally, congestion will be experienced outside the traditional peak hour, according to the model. Finally, given HOV volumes on the Papago, Black Canyon and segments of the Squaw Peak Freeway (assuming an occupancy requirement of two or more people) would be approaching 1700 peak hour vehicles in year 2020, there would not be any excess capacity to sell for a single lane High Occupancy Toll (HOT) facility. However, other HOV lanes (as shown in Figure 4-6), such as on the Superstition, Red Mountain and Maricopa Freeways, appear to have available capacity for potential solo driver buy-in.

4.2 Enhanced HOV System Strawman

Based on the adopted HOV System forecast results presented above, additional HOV corridors were considered, modeled and evaluated for purposes of developing an Enhanced HOV System. In this activity, the focus was on the near term (e.g., 2010 to 2020 era). Initial recommendations were reviewed with the Interagency HOV Committee and resulted in the Enhanced HOV System Strawman, shown in Figure 4-7. Specifically, the Enhanced HOV System Strawman included the components of the Base HOV System (Figure 4-2), supplemented by the additional HOV lanes and connectors listed below in Section 4.2.1.

Figure 4-7
Enhanced HOV Lanes Strawman



4.2.1 Additional HOV Lanes

The following HOV lane additions and connectors were incorporated into the Enhanced HOV System Strawman:

- Papago – Considered two options for the Papago HOV lane extension from its current termination point at SR-101/Agua Fria. For the first option, due to the widening cost associated with crossing the Agua Fria river between 115th Avenue and Dysart Road, the HOV facility was terminated at 115th Avenue. In the second option, the HOV facility was extended to Bullard Avenue to evaluate its viability via forecasted HOV volumes and cost effectiveness calculations
- Agua Fria – HOV lane addition in each direction from Papago (I-10) to Black Canyon (I-17).
- Pima – HOV lane addition in each direction from Black Canyon (I-17) to Red Mountain (SR 202).
- Pima/Price – HOV lane addition in each direction from Red Mountain to the Santan.
- Santan – HOV lane addition in each direction from the Price (SR 101) to McQueen Avenue.
- Superstition – HOV lane addition in each direction from SR 202 to Tomahawk Road.
- Black Canyon/Maricopa – HOV lane extension of Black Canyon (I-17) from Grand Avenue to the Maricopa (I-10) in each direction.
- Black Canyon – HOV lane extension in each direction from SR 101 to Carefree Highway.
- Santan – Extend the HOV facility in each direction from the Price (SR 101) to the Maricopa (I-10)
- Red Mountain – Extend the HOV facility in each direction from Price (SR-101) to Gilbert Road.
- Maricopa – Extend the HOV facility in each direction from the Santan (SR 202) to Queen Creek Road.

Furthermore, additional HOV capacity was considered on HOV facilities approaching their operational capacity. Additional model runs were performed to assess the viability of two HOV lanes in both directions on each of the following facilities:

- Black Canyon – Since the Long-Range Plan included the addition of another lane in each direction on Black Canyon, these lanes were evaluated as HOV lanes from SR 101 to Grand Avenue. At Grand Avenue the second HOV lane terminated into a general-purpose lane. This second set of HOV lanes on Black Canyon would require significant right-of-way acquisition; and the construction cost estimate from ADOT is $1.015 billion.
- Papago –A second HOV lane was evaluated in each direction from Agua Fria to Black Canyon. The second HOV lane terminated into a general-purpose lane prior to the Black Canyon interchange.

4.2.2 Additional HOV Connectors

An assessment was also performed to determine the appropriateness of HOV connectors linking HOV lanes on intersecting freeways. This assessment was based on reviewing the HOV and general-purpose forecasts at each of the freeway-to-freeway interchanges.

Based on the above assessment, the following bi-directional HOV connectors were modeled and evaluated in the Enhanced HOV System Strawman:

- Agua Fria to the east leg of Papago
- Agua Fria or Pima to the south leg of Black Canyon
- Pima to the south leg of Squaw Peak
- Price to the east leg of Santan
- East leg of the Maricopa I-10 to the Maricopa I-17
- North leg of the Maricopa to east leg of the Santan

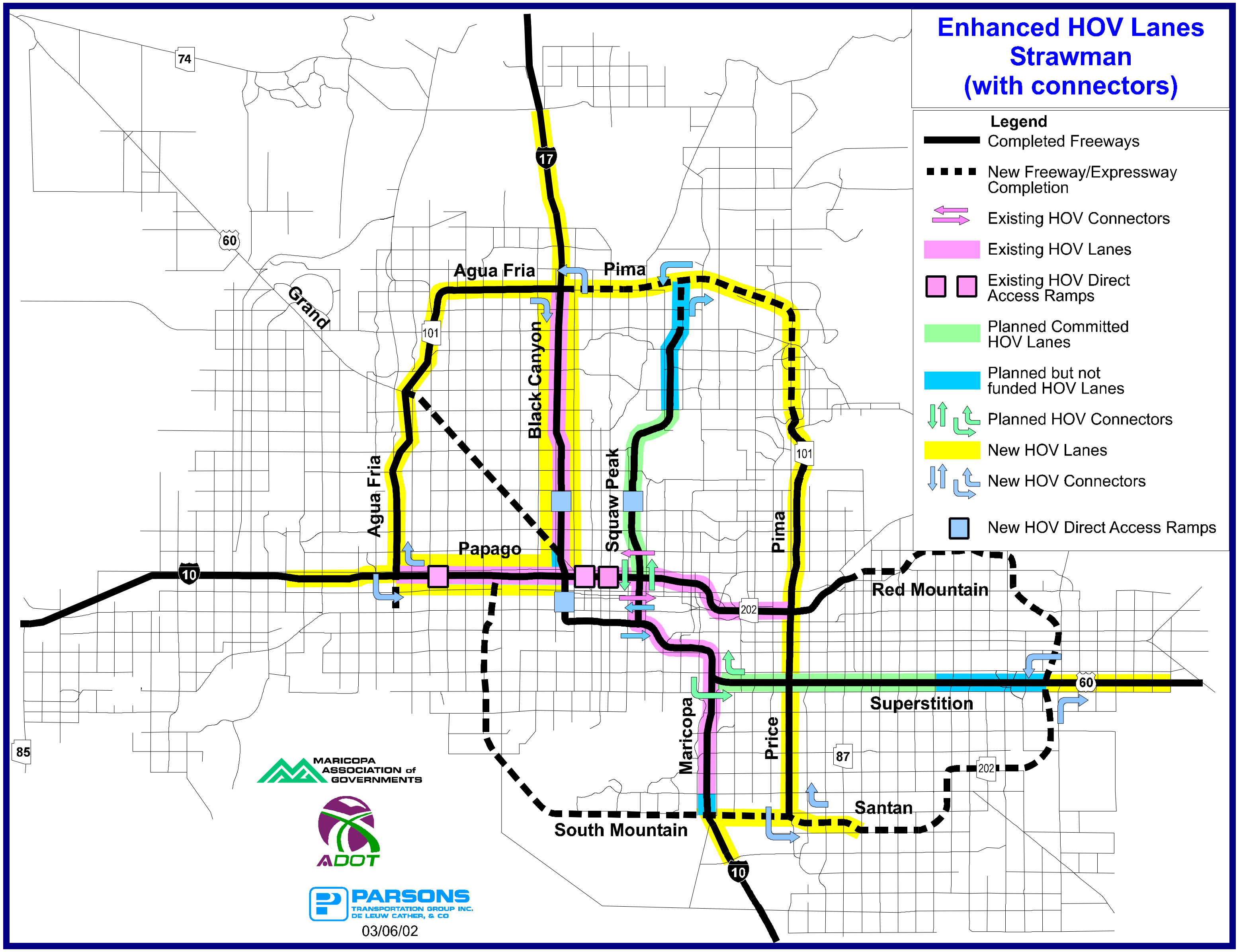
The above HOV connector recommendations are depicted in Figure 4-8. In addition, model runs were conducted to evaluate the best orientation of HOV connectors at the Squaw Peak/Pima and Black Canyon/Pima/Agua Fria interchanges. The recommended options are shown in Figure 4-9.

4.2.3 Enhanced HOV System Strawman Assessments

Additional HOV Lanes — Using the HOV lanes guiding principles discussed in Section 2.3, the overall determination was that the majority of the new HOV lanes were likely to exceed the minimum level of 600 vehicles per lane per hour during the peak periods prior to 2020. The time-priority of these new HOV lanes was evaluated as part of the HOV system recommendations discussed in the next subsection.

Of particular interest in the Enhanced HOV System case was the viability assessment of adding additional HOV capacity (e.g., a second pair of HOV lanes) to existing HOV facilities approaching their operational capacity (e.g., Papago and Black Canyon). These alternatives are part of the existing MAG freeway master plan and are considered to be preferable to conversion to HOV-3 requirements. The conclusions were disparate: yes for Papago and no for Black Canyon. The second pair of HOV lanes for Black Canyon did not meet the 600 vehicles/lane/hour minimum criterion in 2020 and the construction cost of $1.015 billion led to the conclusion that a second pair of lanes on I-17 does not seem viable (at least prior to 2020). On the other hand, the second pair of lanes on Papago between the direct access ramps at 79th and 5th Avenues were recommended in the 2010 timeframe. The peak hour HOV volumes are forecast to increase by 500 to 700 vehicles, the mixed flow lanes are very congested, and the cost of construction is not excessive since the right-of-way for the added pair of HOV lanes is in the center median for this 10.7-mile segment.

Figure 4-8
Enhanced HOV Lanes and Connectors Strawman



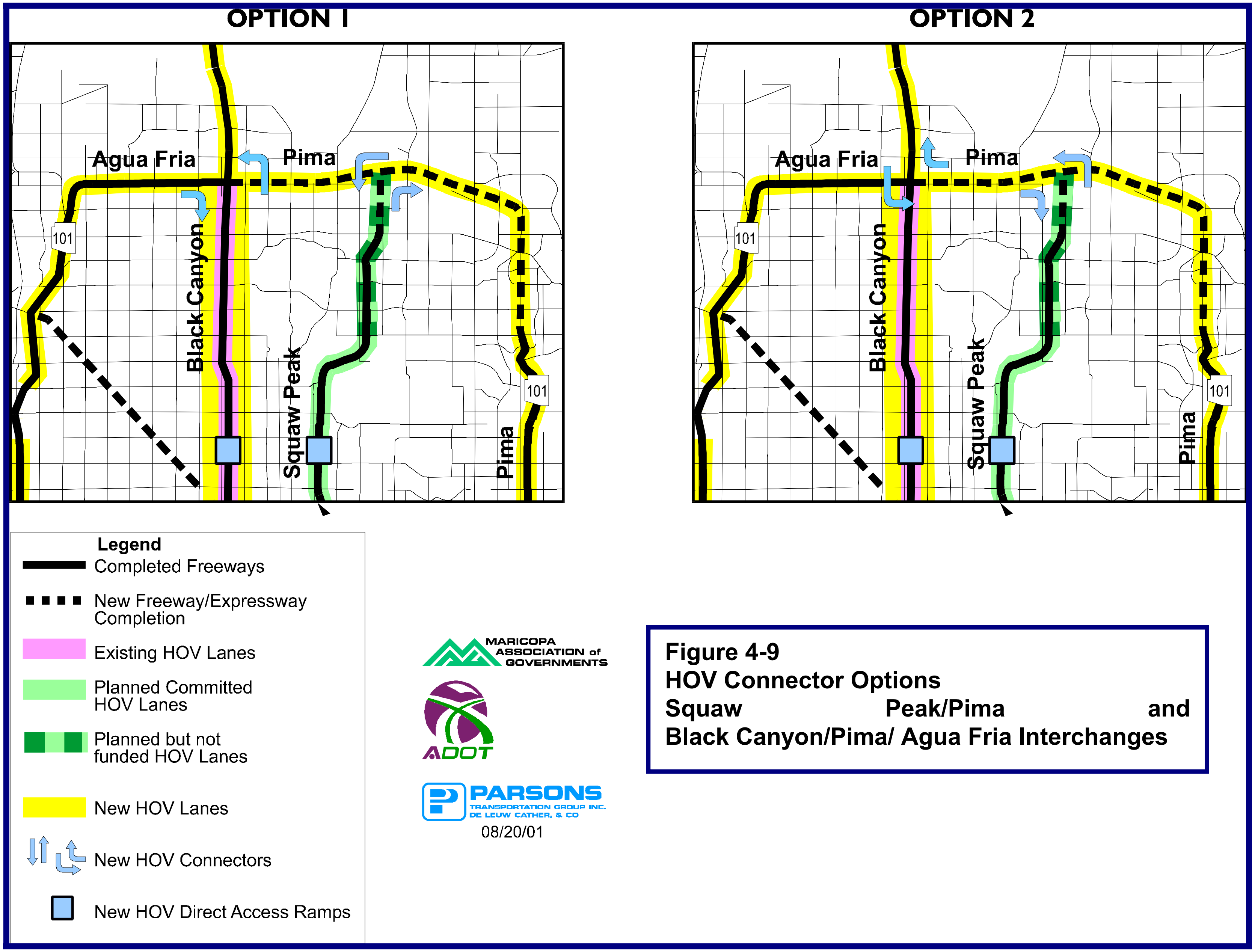


Figure 4-9
HOV Connector Options
Squaw Peak/Pima and
Black Canyon/Pima/ Agua Fria Interchanges

Additional HOV Connectors — Using the HOV lanes guiding principles discussed in Section 2.3, the overall determination was that the majority of these new HOV direct connectors were likely to reach the minimum level of 300 vehicles per hour during the peak periods prior to 2020. The time-priority of these new HOV facilities was evaluated as part of the HOV system recommendations discussed in the next subsection.

In addition, the model results determined that Option I (shown in Figure 4-9) should be the recommended HOV connector alternative orientation. Therefore, Agua Fria to/from Black Canyon south is the recommended connector orientation at the I-17 and SR-101 junction. Likewise, Pima (to the east) to/from Squaw Peak south is the recommended connector orientation at the SR-51 and SR-101 intersection.

HOV Direct Access Ramps — Direct Access ramps for HOVs were considered at several locations to accommodate HOV movements into the downtown area and facilitate express bus access to major transit centers. Each HOV direct access location would consist of a dedicated ramp connecting the freeway HOV facility to either an overcrossing or undercrossing arterial. The criteria for direct HOV access viability were similar to the HOV connector criteria. Potential direct access ramps at Black Canyon near Maryland Avenue and at Squaw Peak in the vicinity of Maryland Avenue had very low forecasted ramp volumes and were not recommended. Direct HOV access from the I-10 to Washington/Jefferson had adequate ramp volumes, but the land availability was limited, such that the construction costs were excessive. Nonetheless, the direct HOV access from the Black Canyon (I-17) at Washington/Jefferson showed good levels of use and was not too excessive to construct (i.e., $50 million). As a result, the HOV system recommendations include new direct HOV access ramps at Black Canyon and Washington/Jefferson to accommodate HOV movements into the downtown area (a much more cost effective alternative to direct HOV connectors between Black Canyon and Papago at the "Stack").

4.3 HOV System Recommendations

As mentioned above, the existing and planned HOV system (Figure 4-10) is performing well and it is recommended that the above system be implemented as originally planned. The existing and planned HOV system, which operates with an eligibility requirement of two or more persons per vehicle, is scheduled for completion by the year 2007 (for the funded elements).

Based upon the public involvement activities and results including briefings to stakeholders and public officials, the long-range, long-term recommendation for the HOV Plan update was developed as an extension of the Enhanced HOV Base. These study recommendations are to begin planning the addition of at least one pair of HOV lanes on all the freeways in the MAG Region. This recommended set of additional HOV lanes is shown in Figure 4-11. Note that the I-10/Papago added HOV lanes shown in Figure 4-11 are a second pair for this corridor. The second set of HOV lanes on Black Canyon are not included due to very high estimated construction costs (over $1 billion).

Figure 4-10
Planned HOV Lanes and HOV Connectors (from 1994 HOV Plan) Near-Completion in 2008

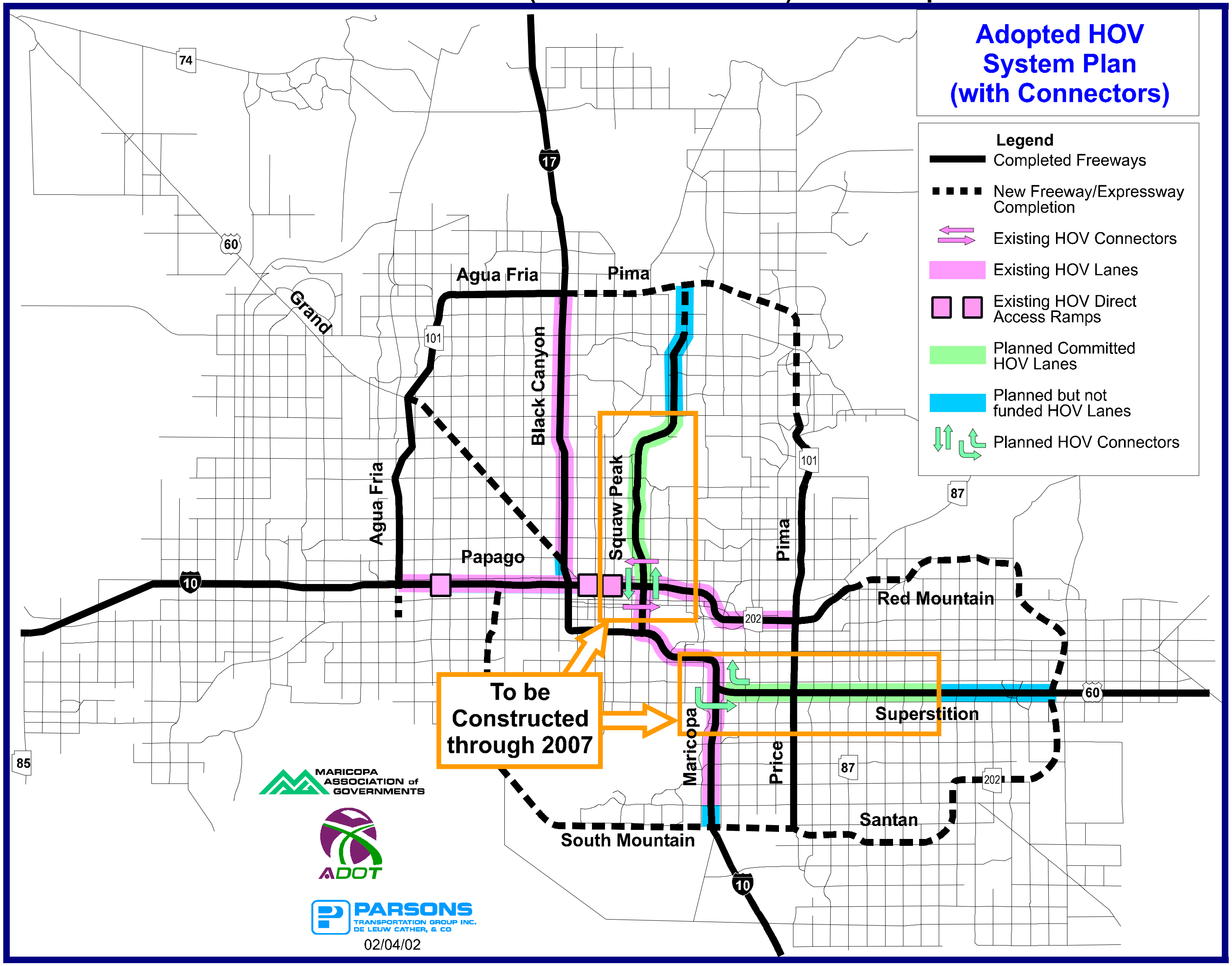
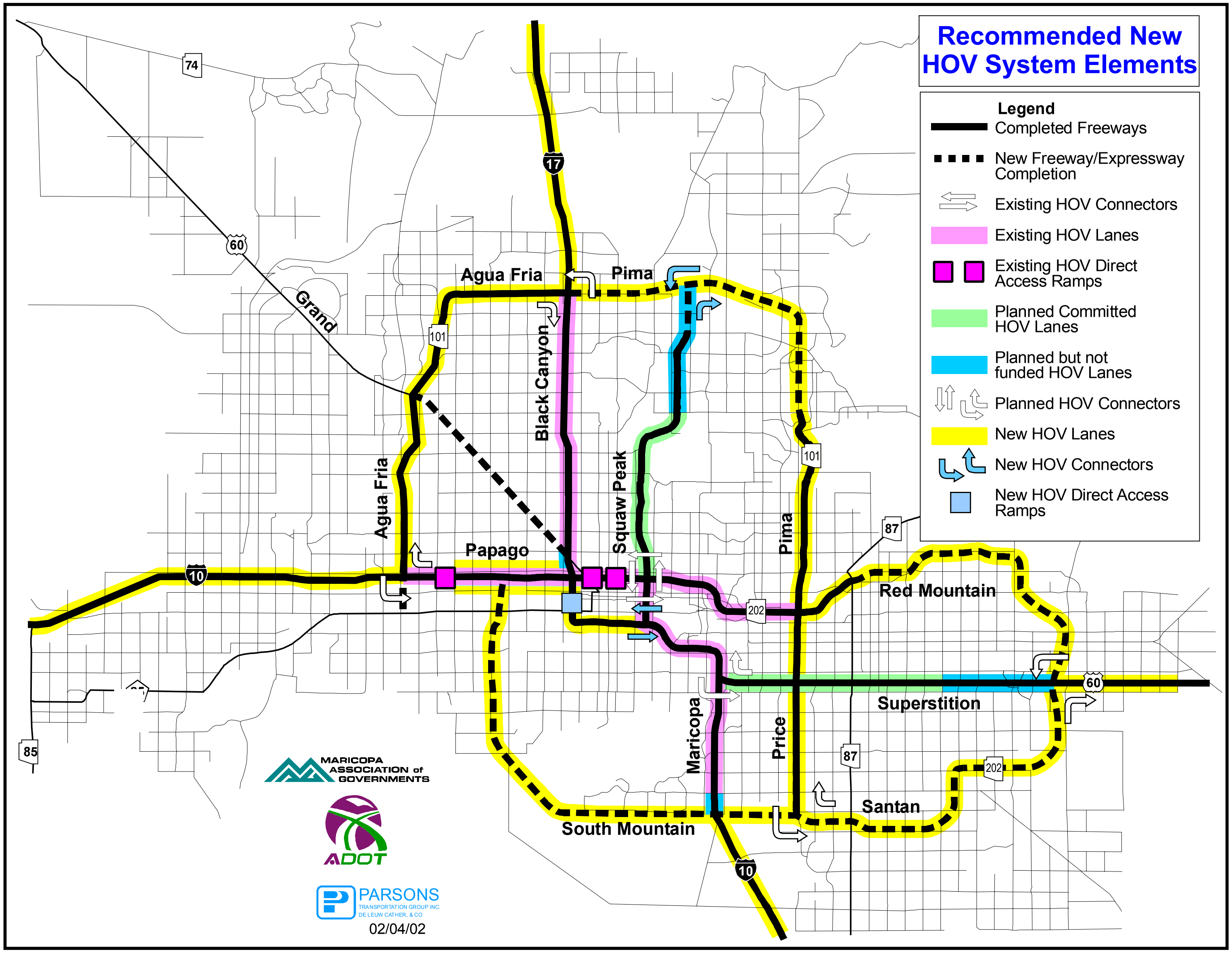


Figure 4-11
Recommended New HOV Lanes and Connectors



Furthermore, Figure 4-11 shows the recommended long-term HOV plan for freeway-to-freeway connectors that evolved from the Enhanced HOV System Strawman described in Section 4.2. Note that this long-term HOV plan was evolved synergistically among the MAG HOV Committee members and consultants, using the Base and Enhanced HOV System Case results. The synergy recommendation was to eventually include HOV lanes on the entire MAG Freeway System. In addition, the synergy recommendation was to plan for a pair of freeway-to-freeway connectors at Superstition and Santan, as shown in Figure 4-11. As with the other recommended connectors, the MAG model results were used to determine the directions for these direct HOV ramps.

To determine how well the proposed additional HOV facilities would perform and whether they should be considered as recommended additions to the adopted HOV system, the cost effectiveness measure previously defined in Table 2-1 was evaluated for the new long-term HOV, as well as for the recommended treatment shown in Figure 4-11, and described above. The cost effectiveness value measures the ratio of the annualized implementation cost and the annualized person hour travel time savings.

The specific cost effectiveness measure used for the Value Lanes study is defined as follows:

Cost Effectiveness = Cost / Benefit, where:

Benefit = (peak hour person movement) x (peak period duration) x (segment length) x (250 days/year) x (travel time savings),

Aggregated for both the AM and PM peaks by direction.

Travel time savings = (1 / general purpose speed) – (1 / HOV lane speed)

Cost = Capital cost estimates annualized assuming a 7% discount rate and 30 year amortization term.

The resulting cost effectiveness ratio was scored as follows:

Legend:

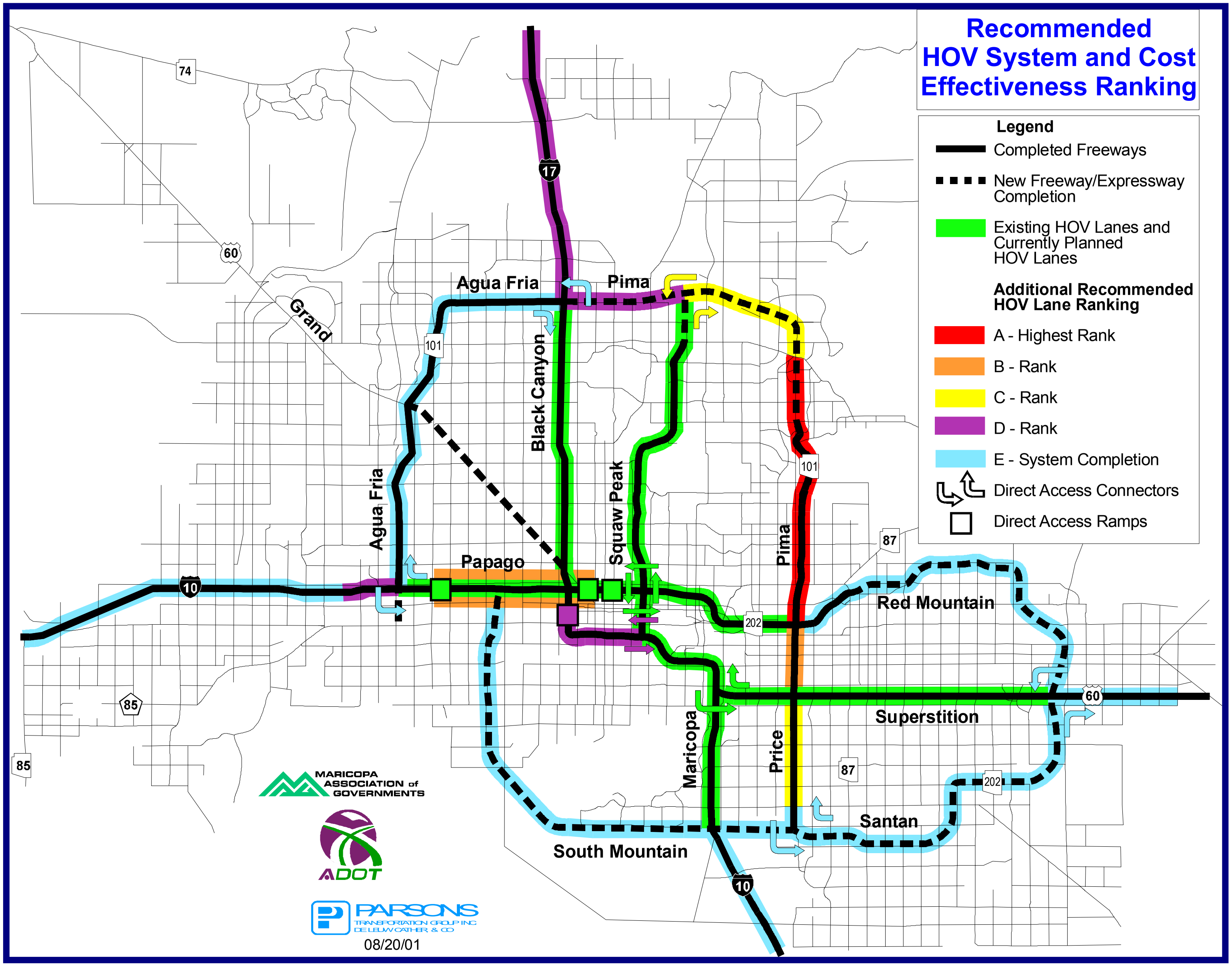
	COST	RANK
1	>$20.00	A = Criteria Not Attained
2	>$10.00 & ≤$20.00	B = Criteria Attained
3	>$5.00 & ≤$10.00	C = Criteria Attained
4	>$2.50 & ≤$5.00	D = Criteria Attained
5	≤$2.50	E = Criteria Attained

The cost effectiveness measure was determined for candidate HOV lanes that were previously defined in Section 4.2 above. Table 4-1 presents the HOV lanes ranked by cost effectiveness value, using the 2020 MAG model results. From this, a near-term primary ranking for these new HOV lanes and connectors has been developed using the cost effectiveness criteria. Those HOV corridors with ranks A through D are recommended for construction prior to 2020.

Table 4-1
HOV Corridor Cost Effectiveness Evaluation Details for 2020
(basis for ranking of newly recommended HOV lanes)

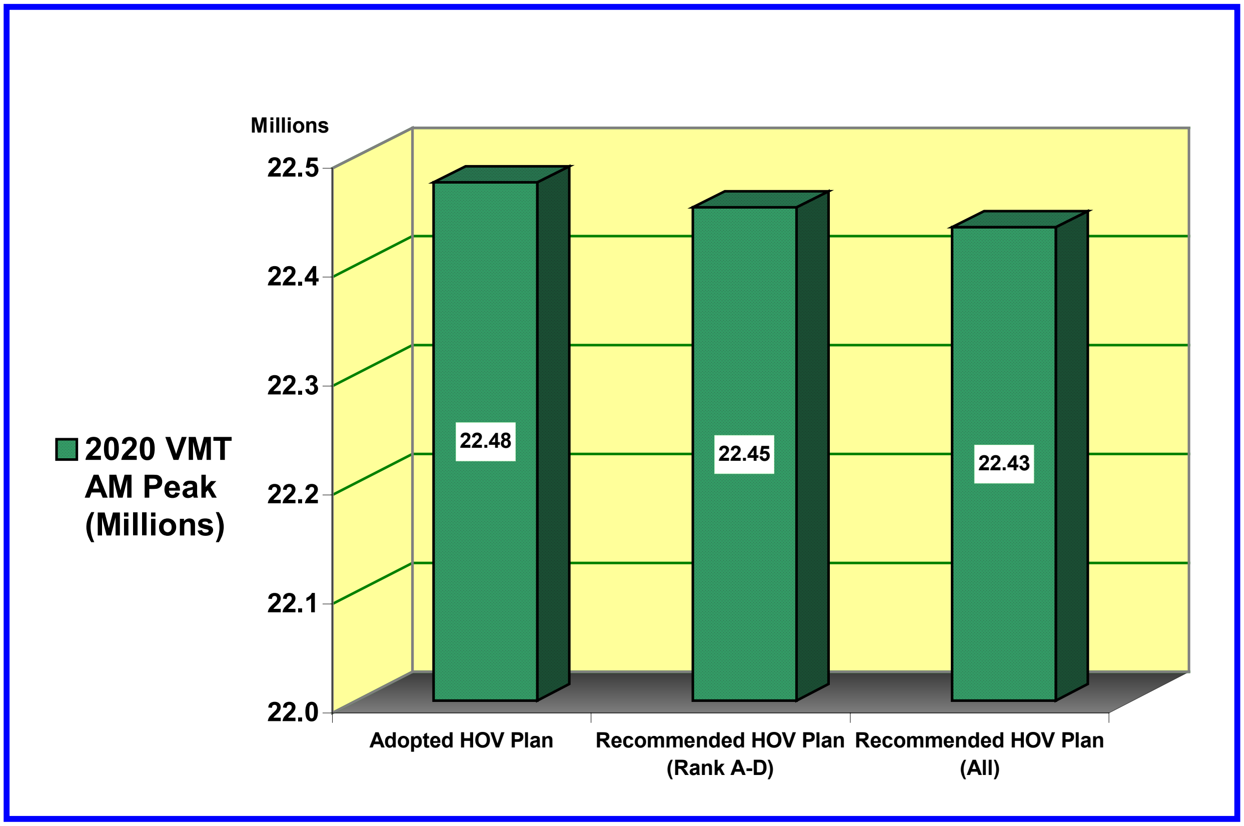
Corridor	Segment	Rank	Cost Effectiveness			HOV Volume		Person Trip Throughput		Speed		Time Savings	Segment Length
			Total Cost (millions)	Value $/hr saved	Score	AM Peak	PM Peak	AM Peak	PM Peak	HOV Lane	Regular Lane	(hours per mile)	(miles)
SR-101 Pima	FL Wright to SR-202	A	$50.61	$1.82	5	1348	1623	2831	3407	50	19	0.0339	14.2
I-10 Papago	79th Ave to 3rd Ave	B	$64.87	$3.25	4	1803	2347	3786	4928	58	23	0.0295	8.4
SR-101 Price	SR-202 (RM) to US-60	B	$12.51	$4.76	4	851	1224	1787	2571	56	27.5	0.0185	3.5
SR-101 Price	US-60 to Chandler Rd	C	$20.30	$8.97	3	500	723	1049	1518	60	30	0.0167	5.7
SR-101 Pima	SR-51 to FL Wrightwith SR-51 / SR-101 HOV connectors	C	$23.83	$9.73	3	630	832	1323	1747	62	35	0.0129	6.7
I-10 Papago	Agua Fria River to SR-101	D	$13.42	$10.45	2	830	1262	1742	2651	59.5	39	0.0088	3.6
I-17 Black Canyon	I-10 (Pap) to I-10 (Mar) with I-10 / I-17 HOV connectors and with Washington/Jefferson HOV direct access	D	$64.56	$12.21	2	978	1456	2054	3058	55.5	28.5	0.0171	6.5
SR-101 Pima	I-17 to SR-51	D	$24.42	$12.48	2	497	653	1044	1370	60	34	0.0127	6.8
I-17 Black Canyon	SR-74 to SR-101	D	$32.16	$14.08	2	595	770	1249	1617	62	39	0.0095	9.0
I-17 Black Canyon	Desert Hills to SR-74	D	$14.29	$14.26	2	385	476	808	999	63	32.5	0.0149	4.0
SR-101 Price	Chandler to SR-202 (San)	E	$3.77	$20.97	1	222	301	467	632	60	30	0.0167	1.1
SR-202 Red Mountain	SR-101 to SR-87	E	$12.76	$24.66	1	273	558	574	1171	61	40	0.0089	3.6
SR-101 Agua Fria	I-17 to 67th Ave	E	$19.15	$24.32	1	439	537	922	1127	61	42	0.0077	5.4
I-10 Papago	SR-85 to Agua Fria River	E	$59.50	$27.04	1	331	510	695	1071	62	41	0.0084	16.0
SR-101 Agua Fria	US-60 (Grand) to I-10	E	$34.54	$31.42	1	502	609	1053	1279	60	46	0.0052	9.7
SR-101 Agua Fria	67th Ave to US-60 (Grand)	E	$37.07	$76.05	1	247	335	519	703	60	48	0.0041	10.4
SR-202 Santan	I-10 to SR-101 (Price)	E	$16.72	$193.22	1	146	252	306	529	60	53	0.0024	4.7
SR-202 Santan	SR-101 (Price) to US-60	E	$66.46	$196.56	1	116	166	245	348	61	52	0.0033	18.6
SR-202 Red Mountain	SR-87 to SR-60	E	$61.68	$255.21	1	102	188	215	394	61	54	0.0025	17.3
SR-202 South Mountain	I-10 (Pap) to I-10 (Mar)	E	$74.32	$465.07	1	1000	1300	2100	2730	62	61	0.0002	20.8
I-10 Maricopa	SR-202 (San) to Riggs Rd	E	$20.58	$15,098.82	1	27	43	57	90	65	64.3	0.0002	5.8

Figure 4-12
Recommended HOV System Plan with Cost Effectiveness Ranking with Direct Access and Connectors



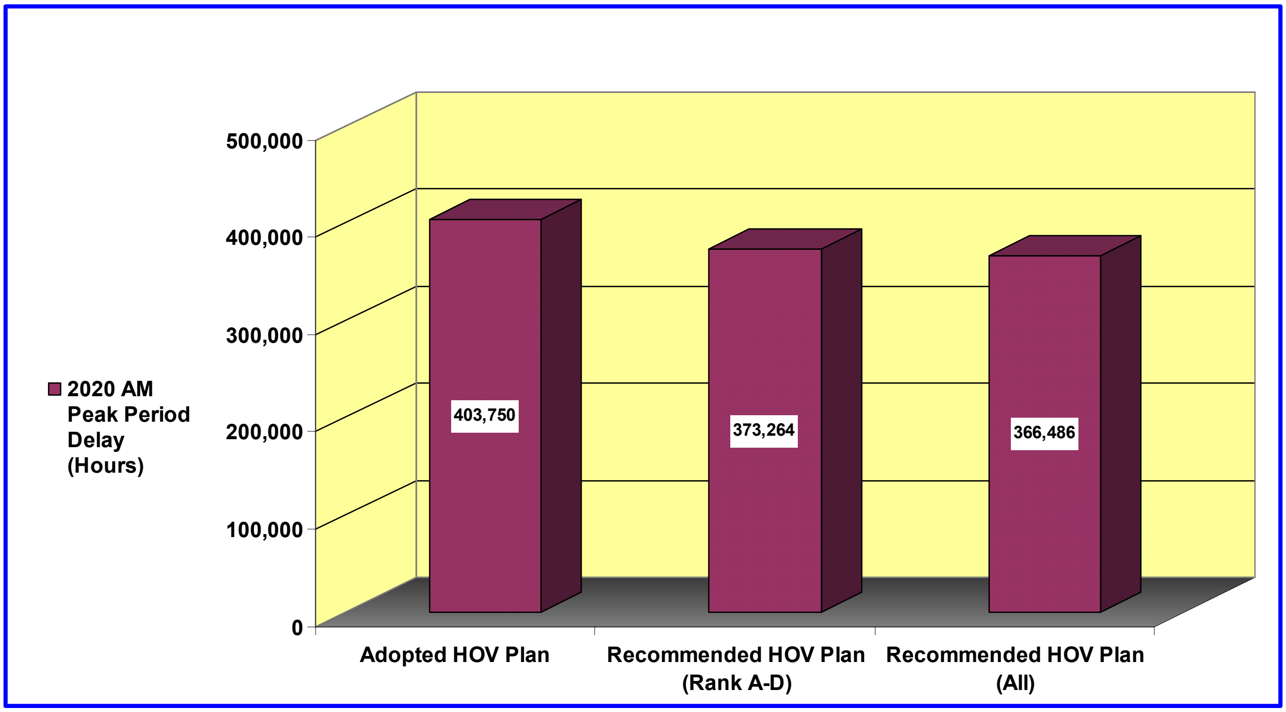
To assess the benefits of the recommended near and long-term HOV system in comparison to the adopted HOV system plan, the MAG model was used to estimate the regional AM peak period's VMT, hours of delay, and HOV trips for each of these three scenarios in 2020. Figure 4-13 shows the VMT for the AM peak period in 2020 for the adopted HOV system, the recommended higher ranking elements of the updated HOV system (rank A through D), and the fully implemented, recommended HOV system (including rank E elements). The VMT decreases by about 0.03 million vehicle-miles (0.13%) between the adopted and the recommended near-term HOV systems.

Figure 4-13
Effect on AM Peak Period VMT of Recommended HOV Plan Additions



The reduction in the AM peak period hours of delay is a more direct measure of the utility of the recommended HOV Plan's new elements. This is illustrated in Figure 4-14 for each of the three scenarios: adopted, recommended (rank A-D), and recommended HOV system (All) plans in 2020. As seen in this figure, the 2020 AM peak period delay is decreased by over 30,000 hours (7.5%) when the recommended priority elements are implemented.

Figure 4-14
Impact on AM Peak Period Delay Hours of Recommended HOV Plan Additions



The increase in home-based work HOV trips is shown for the same three scenarios in Figure 4-15. The recommended priority elements of the HOV plan increase the number of HOV trips from 130,000 to 171,000, which is nearly a 31% increase in HOV trips for the MAG region. This would certainly increase the mobility and vehicle occupancy on the region's freeways.

The increase in all HOV trips is shown for the same three scenarios in Figure 4-16. The recommended priority elements of the HOV plan increase the number by HOV trips from 366,000 to 506,000, which is a 38% increase in HOV trips for the MAG region. The increase in all shared ride trips is not as large as that for HOV trips; it increases from 6,150,000 to 6,162,000 which is a 2% change. These numbers illustrate that there are many vehicle trips where people are sharing the vehicle. The priority HOV elements are predicted to increase the percent of carpoolers that use HOV lanes from 6% to 8%.

Figure 4-15
Effect on Home-Based Work HOV Trips of Recommended HOV Plan Additions

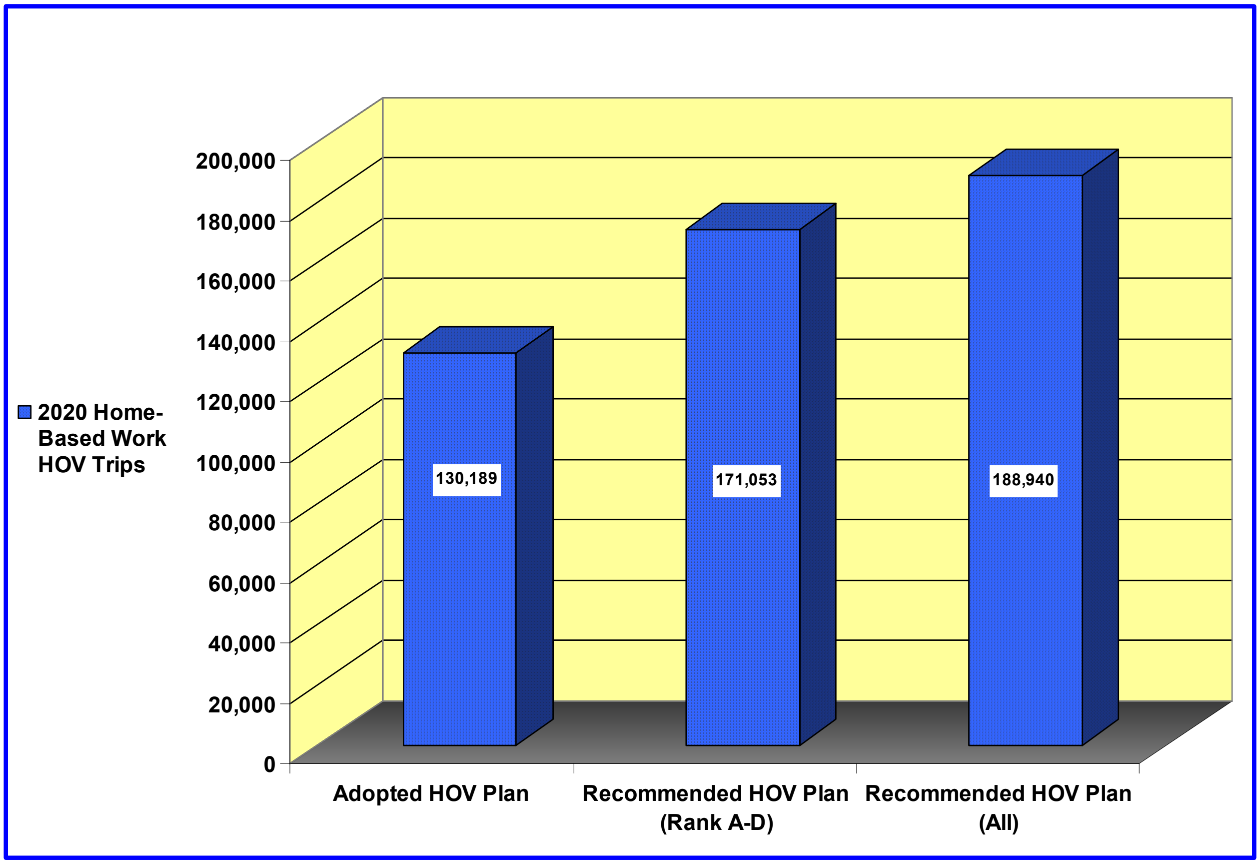
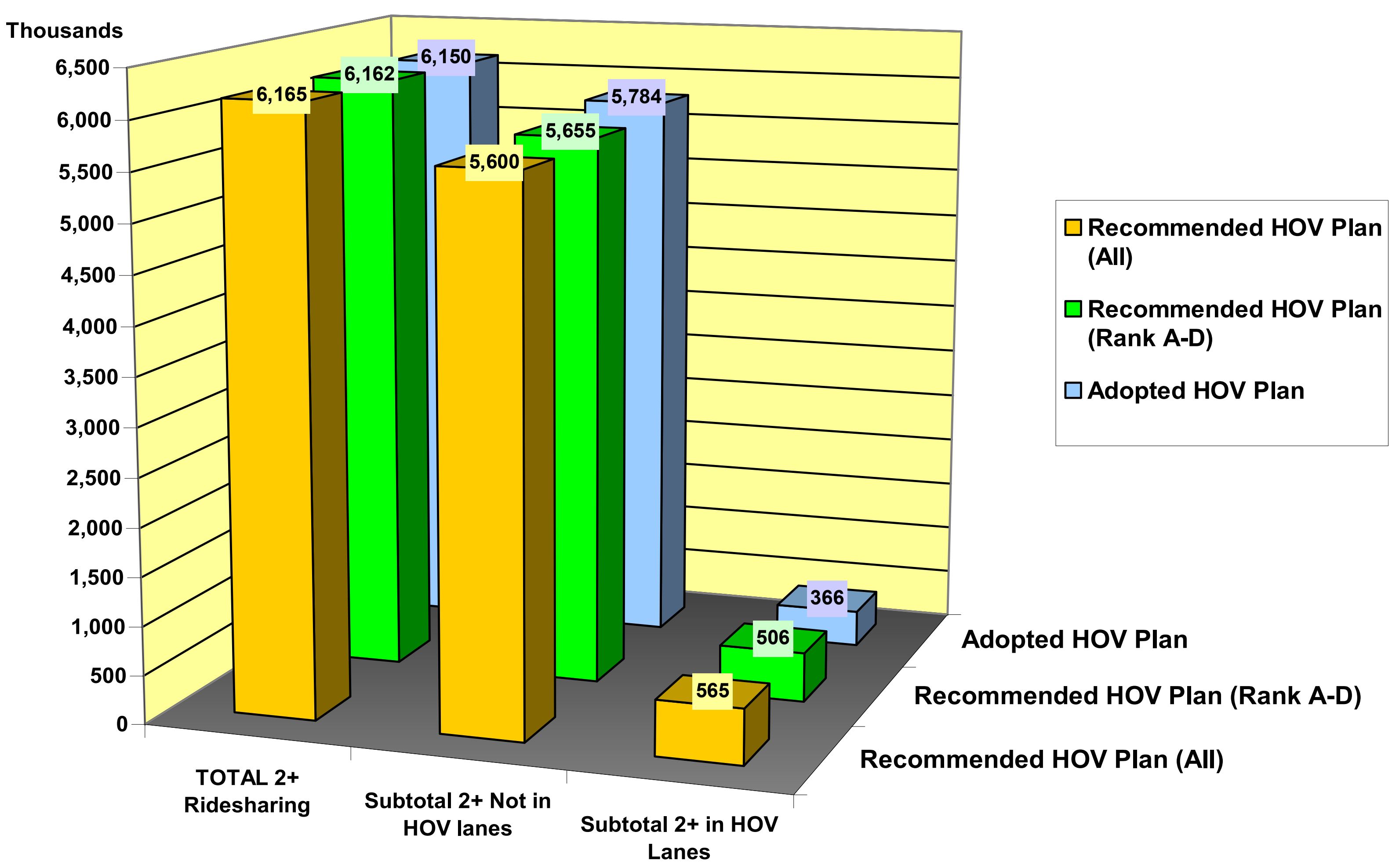


Figure 4-16
Effect on Rideshare Trips of Recommended HOV Plan Additions



SECTION 5: DIRECT HOV ACCESS RAMP RECOMMENDATIONS

Evaluations were also made for four direct HOV access locations that would connect local streets to the mainline freeway HOV facility (i.e. similar to 3rd Avenue and 3rd Street with I-10) as summarized below:

- Direct HOV access from the Black Canyon (I-17) to Washington/Jefferson

  Evaluation: Recommend implementation as it provides an appropriate access point to the downtown area for the HOV traffic using I-17.

- Direct HOV access from the I-10 to Washington/Jefferson

  Evaluation: Direct access ramp volumes very low. Do not implement.

- Direct HOV access from the Black Canyon and Squaw Peak in the vicinity of Maryland Avenue.

  Evaluation: Direct access ramp volumes very low. Do not implement.

Therefore, direct HOV access ramps on I-17 Black Canyon Freeway at Washington and Jefferson Streets are the only recommended addition to those already existing. These recommended future access ramps are shown in Figure 4-12.

SECTION 6: HOV BY-PASS AT ON-RAMPS RECOMMENDATIONS

6.1 Analysis of Current Policy

The 1994 HOV Plan established a policy of providing HOV priority entrances to the freeway system, to be accomplished by introducing HOV bypass lanes at metering locations. This policy was followed and worked reasonably well for a time, but its effectiveness began to decrease significantly. There were several reasons for the decline. Three reasons are detailed below.

1. As interchanges have been improved or reconstructed, dual left turn lanes were typically included for access to freeway on-ramps. Free right turn lanes were also often introduced for traffic accessing the on-ramp from the other direction. These improvements increased the vehicle volume on the on-ramp, overloading the SOV lane used to queue SOVs for the ramp meter. When the SOV queuing lane is filled up, vehicles turning in from the second left turn lane find it difficult to merge into the SOV lane. These vehicles may also be blocking the use of the HOV bypass lane. This often leads to the SOV vehicles using the HOV bypass lane to access the freeway and not stopping for the ramp meter. This sometimes leads to the vehicles in the SOV lane running the ramp meter as well. During peak periods, recorded violation rates have exceeded 45%. When an HOV bypass lane was metered as a trial, the violation rate in that bypass lane was not reduced at all. The high violation rate also increases the chance of road rage situations occurring.

2. The HOV traffic using the HOV bypass lane generally travels at speeds of thirty to forty miles per hour, while the vehicles in the SOV lane are usually released by the ramp meter from a complete stop. When vehicles moving at such disproportionate speeds are forced to merge shortly beyond the ramp meter, sideswipe and rear-end accidents are more likely to occur.

3. Newer freeway designs now typically include auxiliary lanes between closely spaced interchanges (generally less than 1.5 miles apart). Auxiliary lanes allow for more efficient weaving into the general-purpose lanes when compared to the standard tapered merge that is typically used for vehicles entering the freeway. As a result of this increased efficiency, more vehicles can be allowed to enter the freeway from the auxiliary lane on-ramp (as long as the mainline freeway is flowing reasonably well), which means more vehicles can be released from the meter. An increase in meter frequency works best operationally in the form of two vehicles being released from two lanes than two vehicles being released together from one lane or one vehicle at a time being released from a single lane at twice the frequency.

As a result of the problems with the HOV bypass lanes, ADOT has converted approximately 20 of them into second metered lanes, primarily in locations where the on-ramp led into an auxiliary lane on the freeway. These conversions have reduced violation rates, improved merging/weaving safety, and increased the number of vehicles able to enter the freeway, while receiving a generally good reaction from the public.

Consequently, ADOT officials have endorsed a general policy change toward providing primarily dual metered on-ramps, both for new on-ramps and as a retrofit strategy. HOV bypass lanes or exclusive HOV/bus entrance ramps should only be considered for on-ramps located in close proximity to park-and-ride lots or express bus routes. Some examples of such locations include:

- Southbound I-17 exclusive HOV entrance ramp at the Park-and-Ride lot south of Bell Road
- Southbound SR-51 express bus pull-out and re-entry at the Shea Boulevard park-and-ride lot
- Southbound SR-51 exclusive express bus entrance ramp planned at Bell Road, adjacent to the current southbound on-ramp

Additional exclusive HOV ramps are being considered at locations adjacent to other park-and-ride lots, including the lot at I-17 and Metro Center.

6.2 Recommended Policy Revision

Given the issues discussed above, as well as in Section 2.3.1 (HOV Guiding Principles), it is recommended that the 1994 HOV system policy be revised. It would be appropriate to consider two potential options for preferred on-ramp configuration, as discussed below:

- Two-Lane General-Purpose On-Ramp - This first option is to provide two general-purpose lanes at the on-ramp and not have an HOV bypass lane. This would be the lower cost option and would be viable, provided there is not a high-volume transit center or large park-and-ride lot in the near vicinity.

- Three-Lane On-Ramp (two general-purpose lanes and one HOV lane) – This second option is to provide one HOV bypass lane and two general-purpose lanes, creating a three-lane on-ramp. This option would require additional right-of-way and would thereby be more costly than the first option. Operational complications arising from triple lane merging/weaving also need to be considered, as does the ability to maintain design standards with this type of on-ramp. This type of configuration should be considered near park-and-ride lot locations and where significant express bus access is planned.

The decisions regarding which type of on-ramp configuration to implement should be conducted on a case-by-case basis. The major considerations for the above decisions include the on-ramp volume, whether there are dual or single left-turn lanes entering the on-ramp, and whether there is a high-volume transit generator (i.e. transit center, large park-and-ride lot) in the area. Consequently, specific recommendations regarding location of HOV by-pass lanes should be developed after the MAG park-and-ride site selection study is completed.

SECTION 7: VALUE LANES RECOMMENDATIONS

The value lanes feasibility task was conducted utilizing traffic demand estimation methodology, operational characteristics, financial potential and capitalization costs and recommendations. Each stage evaluated alternative HOV corridors for financial feasibility as value lanes (i.e., HOT lane facilities that use dynamic value pricing).

The stages and the study cases are illustrated in Table 7-1 below. The existing conditions incorporated existing and future design year traffic volumes, congestion and freeway operational characteristics. Data was obtained from the 1998 MAG Regional Congestion Study. For the purposes of this study, current congestion levels are presumed to be at least equivalent to those levels documented in 1998.

Table 7-1
Stages of Value Lanes Feasibility Study

Stage/Case:	Design Year	Operational Period Assessed	Conclusions:
1. Existing HOT Ops. Feasibility Assessment	2000	2000 (= 1998)	▪ I-10 congested, but no available HOV capacity *(see subsection 7.1)*
2. Base HOT Case (planned HOV lanes)	>2008	2010 & 2020	▪ Where congested, insufficient available HOV capacity
3. Enhanced HOT Case (planned and new HOV lanes)	>2008	2010 & 2020	▪ Synthesized recommended core network of five HOT corridors *(see subsection 7.2)*
4. Recommended HOT Case (core network of HOT corridors)	>2008	2010 & 2020	▪ Determined fiscal feasibility of 5 corridors and selected Demo Project *(see subsection 7.3)* ▪ Evaluated operations impact and benefit *(see subsection 7.4)*

The first criteria compared used traffic demand estimates based upon actual and modeled traffic using I-10 and I-17 and the MAG freeway system data. The most reliable demand estimation method that has the capability to incorporate most of the demand components is the application of a four-step travel demand forecasting model provided by MAG. This process was grouped into the traditional steps of trip generation, trip distribution, mode choice and network assignments. The MAG model included the value of time, toll elasticities of demand and cost trade-off decisions, which affect the choice of mode and route selection. The lack of continuity and connectivity between valley freeways affects the viability of system choice and mobility. Thus it becomes necessary to make numerous model runs under varying toll rates, overall traffic volumes and other assumptions to fully assess the potential for HOT lane demand for different user groups and/or times of day, frequency of usage etc., which are cornerstone for estimating toll elasticities of demand. The objective of this study was to determine the market share of existing and potential travel that could be captured under various HOT lane pricing schemes.

MAG model runs were used to forecasts traffic conditions in 2010 and 2020 for the planned completion of the valley freeway network and incorporated various alternative HOV lane configurations included the buildout of all valley freeway HOV lanes through 2020 based upon ADOT-MAG prioritization and availability of future funding as discussed in Section 4.

The first stage included the evaluating of operational feasibility of existing HOV facilities as potential HOT lanes using the design year 2000. The results are described in subsection 7.1. The remaining stages utilized the design year to be 2010 (e.g., when the adopted 1994 HOV network is completed). It should be noted that HOT lane demand forecasts were presented using a range of volumes over a specified time interval (i.e., per peak hour, peak period, weekday, year) ranges rather than as absolute volumes. Previous modeling has demonstrated that precise figures for demand projections are seldom achieved but are not quickly forgotten by decision-makers, the media or the public.

Estimating revenue can be extrapolated once demand project projections were prepared. The revenue projections for the five recommended freeway corridors was predicated upon the potential variation of traffic and route choice decisions by time of day and day of week and especially applicable were the geographic distribution of users based upon origination and destination data. Demand estimates were subdivided by categories such as vehicle occupancy and time of day/traffic conditions which also were dynamically priced in relation to congestion levels on “free” lanes while managing demand on the tolled lanes to maintain level of service D or better. As with travel demand forecasts, HOT lane revenue projections were presented in ranges rather than in absolute values, with a range for each category or group of traffic forecasted. The analysis reflected in Table 7-1 incorporated toll collection technology, enforcement issues and facility design, allowances for non-compliance (toll violations) and/or fraudulent use or uncollectible accounts which were factored into revenue projections contained in Table 7-5.

The second stage (Base HOT Lane Case) evaluated the potential for using previously planned sets of HOV lanes from the MAG 1994 HOV Plan. As noted in Table 7-1, the Base HOT Lane Case concluded that insufficient availability of HOV capacity would be available when the other freeway lanes were congested. The third stage, the Enhanced HOT Lane Case, evaluated the planned and new HOV lanes (refer to Section 4) for potential HOT lane operation. The Enhanced HOT Lane Case involved identifying alternative corridors for implementation after 2008 for an initial set of HOT lane model runs and fiscal evaluations.

From these alternatives a synergistic network of five HOT lane corridors were identified and considered viable for recommendation. The fourth and final stage involved selecting and evaluating the resultant five corridors within this potential network of value lanes for the metropolitan area. The remainder of this section describes the results and conclusion of three of these four cases.

The enabling conditions used for Value Lane fiscal feasibility, as defined in subsection 2.4.2, are:

- There is congestion in the general-purpose lanes;
- Available capacity in the existing or proposed HOV lanes.

Then, for corridors that satisfy these conditions, a fiscal study of the traffic forecasts provided by MAG evaluated whether the net revenues of the Value Lanes were sufficient to self-fund implementation and operation enforcement. As stated previously, positive net revenues (after operations, maintenance and enforcement expenses) are needed if the Value Lanes are to be fiscally viable. The net revenues must also be sufficient to self-fund implementation (toll system installation and lane construction and bond debt service, as needed) of the HOT Lane facilities.

The methodology of these fiscal evaluations is provided in Appendix E. Finally, the operations of the freeway and the adjoined HOT lane facility must show that the levels of service and volumes (in both general-purpose and the HOT lanes) are consistent with those intended; hence, allow viable operation and safety.

Recommendation

This study evaluated the five selected potential HOT lane corridors for consideration as an initial Value Lanes demonstration project (e.g., using FHWA Value Pricing Program Office funding, if available), which could potentially be used to determine actual patronage and the Valley's acceptance of Value Lanes. The evaluation compared alternative corridors for such a demonstration and developed a recommendation that the initial demonstration project be a second set of HOV lanes on I-10/Papago from 79th to 3rd avenues. This fiscal feasibility and assessment of operations are discussed below.

7.1 Value Lane Operational Analysis of Existing Conditions

The freeways 'HOV lanes' volumes by direction for the existing conditions (e.g., the 1998 base year) are shown in Figures 7-1 and 7-2 for the AM peak hour and PM peak hour, respectively. Figure 7-1 corresponds to the AM peak period congestion assessment diagrams shown in Figures 4-3 and 4-4 for the freeway mixed flow lanes and the HOV lanes, respectively. Table 7-2 provides a summary assessment of the operational feasibility of Value Lanes for the existing HOV facilities for the corridors with current levels of heavy congestion. As is illustrated in Figures 7-1 and 7-2, as well as Figure 4-3, and summarized in Table 7-2, for most of the corridors, there is either minimal freeway congestion (e.g., F_o, durations of less than 1 hour of level of service F) or there is no spare capacity in the HOV lanes (i.e., western I-10/Papago). There is some available capacity in the HOV lanes on SR -202/Red Mountain as well as on the I-10/Maricopa HOV lanes (south of the airport). However, the periods of freeway congestion are less than one hour in duration for the existing conditions. Hence, the focus for the Value Lanes' feasibility assessment was to look to the 2010 era and beyond when the congestion is forecast to be much worse on the freeways and when the demand for the available HOV capacity would be of longer duration.

Table 7-2
Operational Assessment Existing HOV vs. Freeway Lanes

Year and Period: **Corridor**	**Freeway Level Of Service***	**Duration of Freeway Congestion***	**HOV Lanes' Volumes*** (veh/lane/hr)	**Potential for Value Lane Operations**
1998 AM Peak Period:				
I-10/ Papago EB	F_1	1.5 hr.	1600	No capacity
I-10/ Papago WB	F_0	<0.5 hr.	1100	Short period
I-10/ Maricopa NB	F_1	1.0-1.5 hr.	1100	Some
L-202/ Red Mtn. WB	F_0	0.5-1.0 hr.	900	Some
1998 PM Peak Period:				
I-10/ Papago WB	F_1	1.0-1.5 hr.	1600	No capacity
I-10/ Papago EB	D	<0.5 hr.	1300	Short period
I-10/ Maricopa SB	F_0	0.5-1.0 hr.	1200	Some
L-202/ Red Mtn. EB	F_0	0.5-1.0 hr.	800	Some

**Source: 1998 MAG Regional Congestion Study, Final Report, September 2000.*
Note: 10% to 50% of vehicles were single occupant based on ADOT's 1996 Occupancy Study (see Appendix F).

Figure 7-1
Existing Conditions HOV Lanes' Volumes By Direction: AM Peak Hour

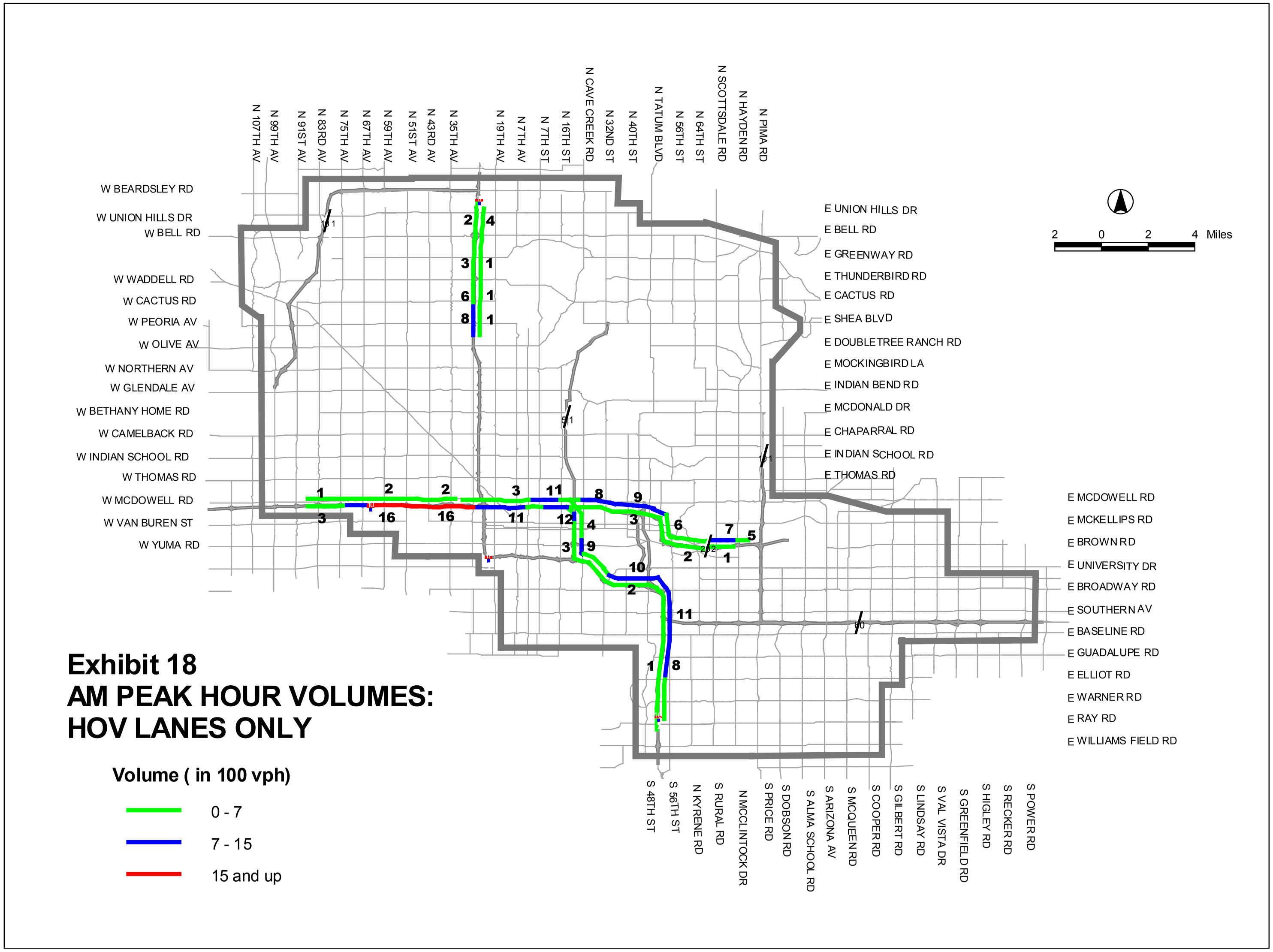
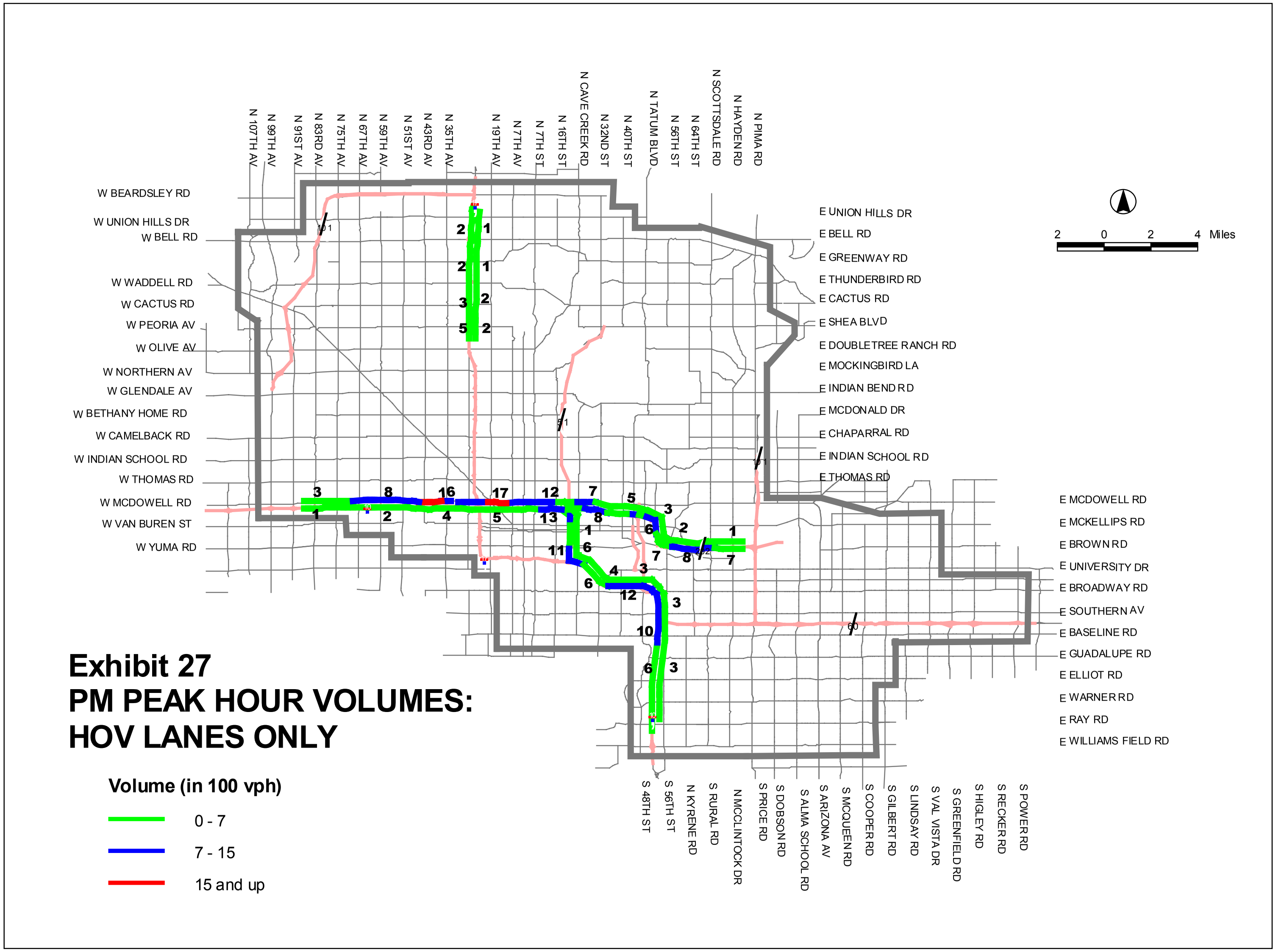


Figure 7-2
Existing Conditions HOV Lanes' Volumes By Direction: PM Peak Hour



7.2 Value Lane Feasibility Results

For the evaluation of Value Lane fiscal feasibility, the MAG model results for the near-term recommended HOV lanes (see Section 4.3) were used to examine available capacity during peak periods. Representative model results for the recommended HOV network in 2020 are shown in Figure 7-3 and 7-4 for the general-purpose lanes and HOV lanes, respectively. These plots, from the MAG model, illustrate the LOS in the various elements of the MAG Region freeway network during the AM peak period. As can be seen in Figure 7-4, there is significant capacity in the "inbound" HOV lanes network during the AM peak in 2020 in all corridors except for I-10, I-17/Black Canyon and L-101/Pima (north of McDowell). And, as shown in Figure 7-3, the multi-use (i.e., general-purpose) lanes are experiencing significant congestion on most of the older "inbound" corridors. From this basis, the study participants concluded that, with the exception of I-17/Black Canyon (due to very high construction/ROW costs of over $1billion, see Section 4.3), all of the near-term recommended HOV lanes were potential candidates for Value Lanes. This premise is illustrated in Figure 7-4, which shows the "old planned" lanes and the new recommended HOV lanes as candidates for Value Lanes.

Based upon this information and synergies among the HOV Committee participants, five candidate Value Lane corridors were identified for the Final Recommended HOT Case. These five candidate Value Lane corridors are defined in Table 7-3. The five candidates are defined together (as a potential network of Value Lanes) in Figure 7-5. Table 7-3 shows the operational variations for these five candidate Value Lane Corridors as well as the MAG model's forecast for HOV volumes (AM peak "inbound" without toll payers). With the capacity of these HOV facilities assumed to be 1400 vehicles/lane/hour (vplph) for one-lane and 1700 vplph for two-lane alternatives, it is obvious that spare HOV capacity is available for HOT lane operation.

As described in the guiding principles (Section 2.4), capacity allowances for HOV and HOT lanes use a maximum threshold of 1,500 vehicles per lane per hour (vplph) for one-lane facility and 1,700 vplph for two-lane facility in order to be at or above level of service (LOS) D (see Appendix E, Table E-4). It is recommended to not allow toll payers into HOT lanes when HOV volumes exceed 1,400 vplph for single lane, and 1,600 vplph for two lanes. This constraint is due to the toll rates start to become excessive when trying to limit toll payers into the 100 vplph cushion and dynamic road pricing begins to break down and does not provide sufficient demand management control.

Table 7-3
Five Candidate Value Lane Corridors for Recommended HOT Case Evaluation

Alternative	# Lanes/ direction	Type	Year	AM Peak HOV Volumes *(vehicles/lane/hr)*	Length (miles)	# Toll Zones	Toll Verif. Zones	Ops
I-10/ Papago	2	New	2010 2020	450-800 600-950	10.7 12.6	2x4 2x5	Yes	24-Hour
L-101/ Pima & Price	1	New	2010 2020	250-600 500-1400	22.5 22.5	2x10 2x10	Yes	24-Hour
US60/ Superstition & I-10/ Maricopa	1	Conversion	2010 2020	600-1100 600-1000	25.9 25.9	2x12 2x12	No	Peak periods
SR-51/ Squaw Peak	1	Conversion	2010 2020	450-900 800-1200	15.8 15.8	2x8 2x8	No	Peak periods
L-202/Red Mountain	1	Conversion	2010 2020	400-450 400-600	9.2 9.2	2x3 2x3	No	Peak periods

Figure 7-3
AM Peak Period Level of Service (LOS) in Freeway Multi-use Lanes in 2020

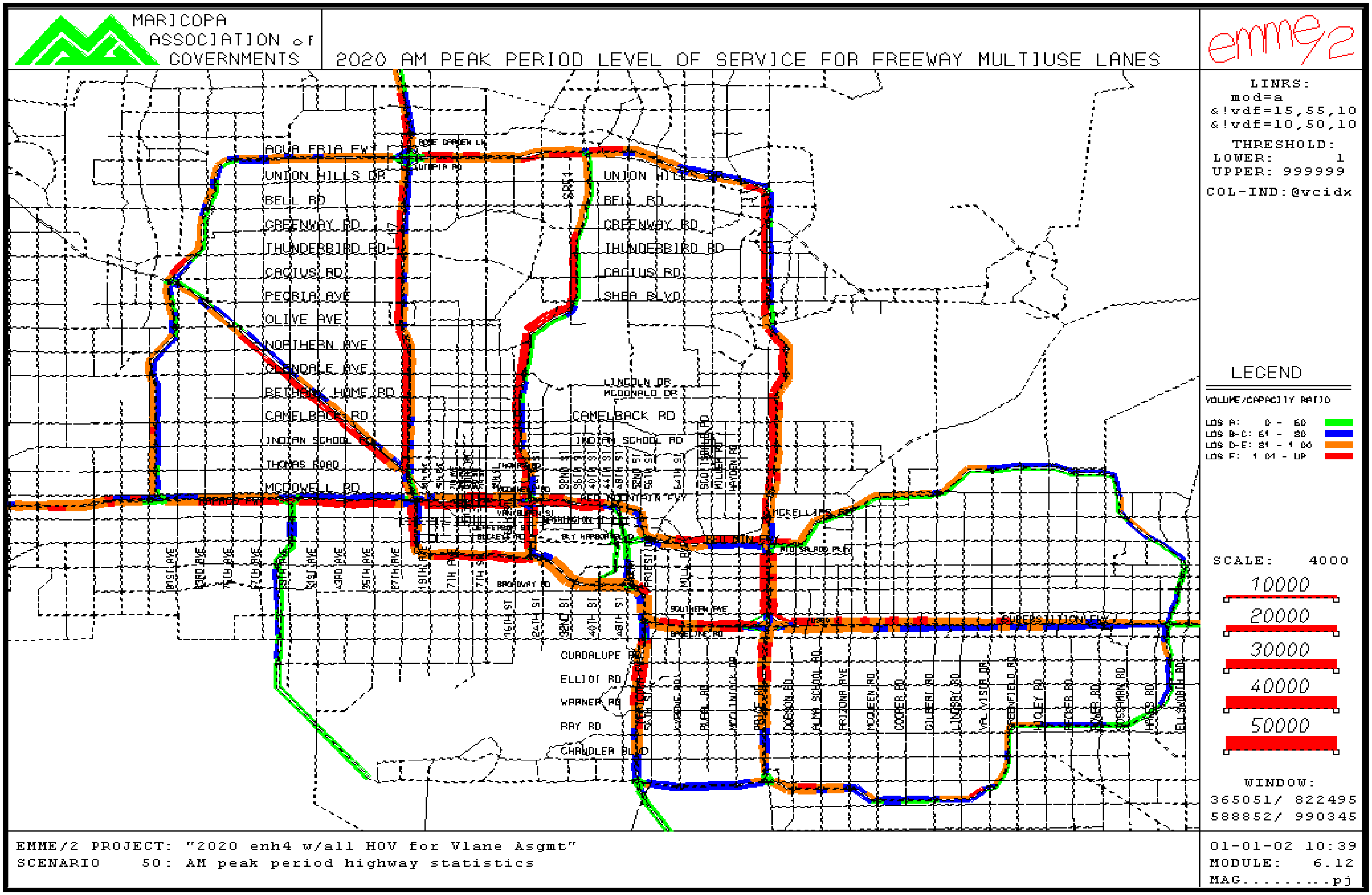


Figure 7-4
AM Peak Period Level of Service (LOS) in Recommended HOV Lanes in 2020

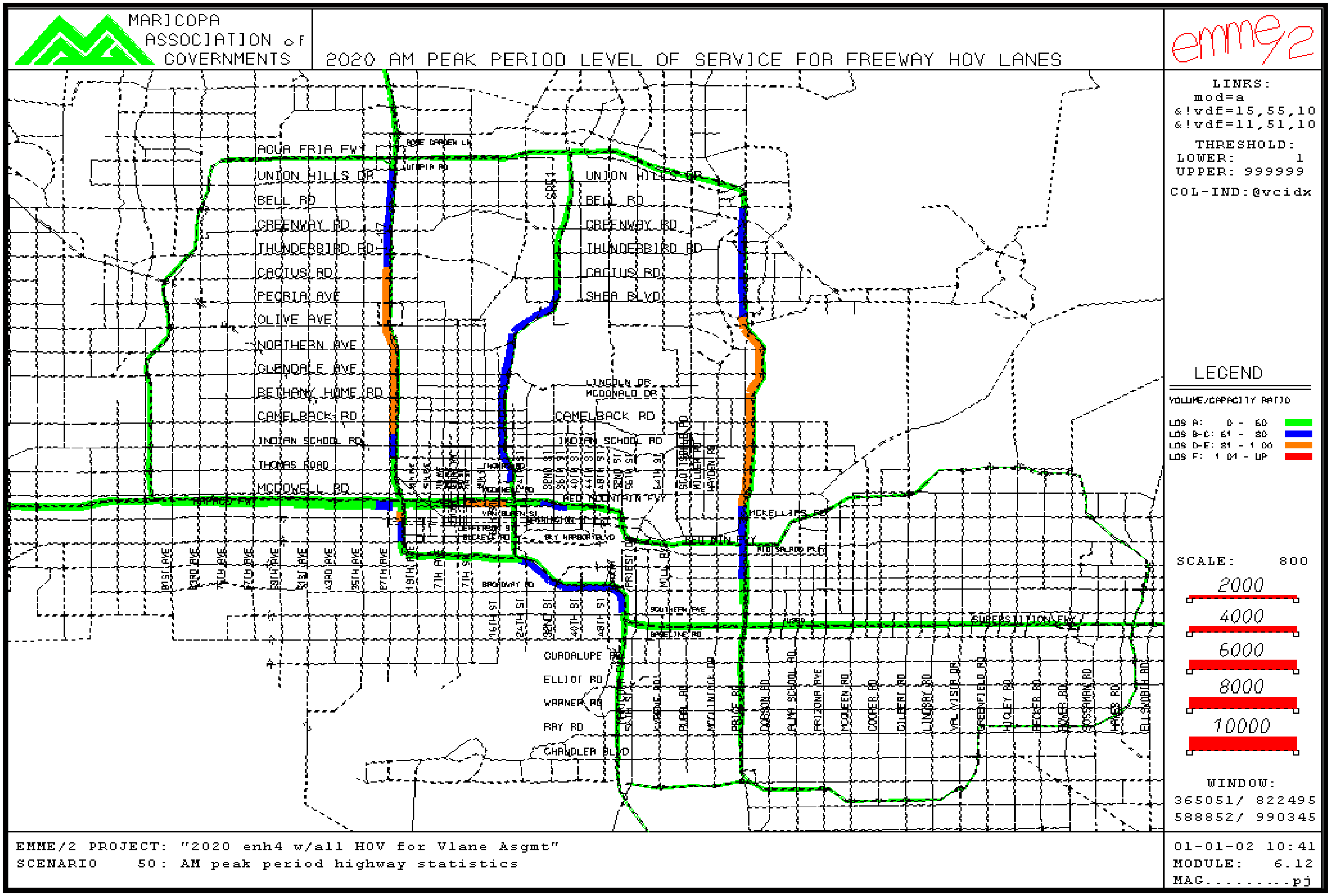
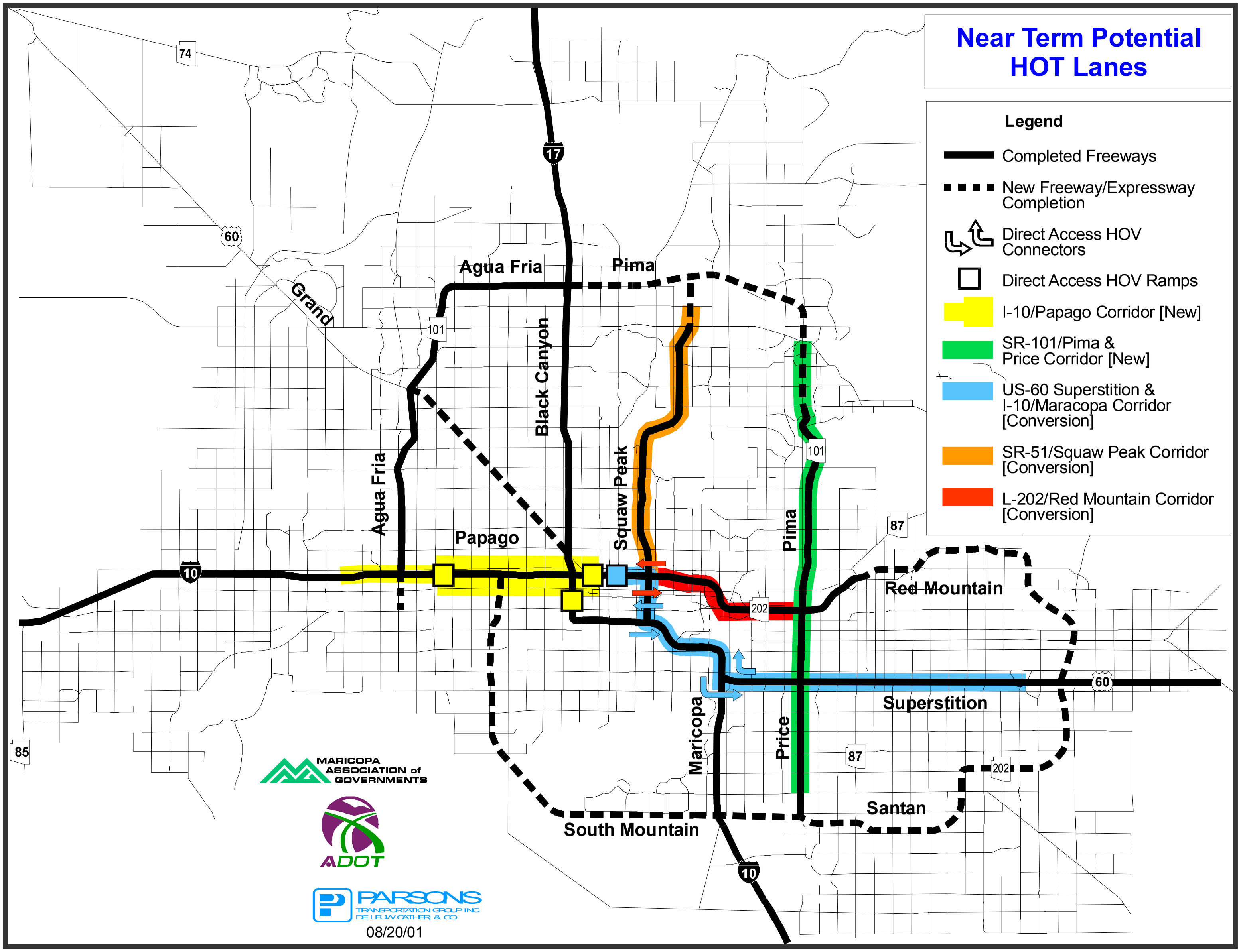


Figure 7-5
Near-Term Potential HOT Lanes: Five Candidate Corridors



7.2 1 Financial Considerations

This section considers some basic financial aspects of HOT lanes from two perspectives: (1) the business operating objective of the facility, which includes the important nature of the owner/operator and (2) issues regarding the estimation of capital investment costs and ongoing operations and maintenance costs at the planning stage.

A. Business Operating Objective

It is important to recognize that Arizona's existing privatization law, A.R.S. 28-3051-3075 currently does not contain language that would enable a private owner/operator to enter into a business relationship with the State to operate toll roads or toll lanes on existing facilities. Restructuring of existing statutes will be necessary before ADOT could participate in a business relationship with a private operator. The business operating objective of a HOT lane facility refers to those financial factors which determines optimal performance of the facility and is especially pivotal for HOT lanes that will be dynamically priced. These objectives include the following criteria:

- Revenue maximization
- Profit (revenue, net costs) maximization
- 100% operating or operating plus capital recovery
- Maximum overall time savings
- Maximum and/or minimum vehicle throughput subject to traffic level of service or minimum speed constraints
- Maximum person throughput subject to traffic level of service (D or better) or minimum speed constraints.

The business operating objective(s) depend upon the nature of the facilities owner/operator. Private sector participation comprises part or all of the facility development and financing. Whereas public facilities may focus on operating efficiency concerns such as throughput or time savings.

B. Capital Investment and Operation/Maintenance Costs

Key to successful management and operation of a HOT lane facility is capital investment and related costs for operations and maintenance. HOT lane administrative and O & M costs include fixed and variable costs which are not associated with public financed facilities. These costs may include:

- Administrative functions including advertising and marketing
- Toll collection electronic hardware, collection activities, account management, legal and distribution costs. Capital investment costs include those normally required for construction and maintenance of public funded highways in addition to those costs involving toll collection, traffic monitoring (i.e., traffic operations facility, sunk costs) and related technology required for business operations.

As shown in Table 7-3, the recommended HOT Case for the three potential "conversion" corridors is to initially operate them only during peak periods and to not add toll/HOV verification lanes to the existing HOV facilities. This is assumed for demonstration project purposes-specifically, to minimize controversy. Note that this is not without impact. For example, as discussed in the sensitivity evaluation provided in Appendix E, operating only during peak periods can have a revenue impact from 10 to 40%—e.g., $2 million to $5 million per year—across these various corridors. Likewise, although the HOV/toll verification lanes can cost about $0.75 million per toll collection zone per direction, the revenue impact is significant (e.g., typically 13-15%, but as much as 35-37%—$1 million to $4 million per year, as shown in Appendix E).

The patronage estimates from the MAG model and the gross tolls per transaction from the fiscal evaluation in Appendix E are shown for the five candidate Value Lane corridors in Table 7-4. As shown, the patronage levels are based upon the available HOV lanes' capacity. The average toll provides a measure of the reasonability of the results. Note that all costs and revenues in this study are in constant, year 2000 dollars.

Table 7-4
Recommended HOT Case Patronage Results Summary

Alternative	#Lanes/ direction	Type	Year	Length (miles)	AM Peak Toll Volumes (v/l/hr.)	Average Gross Toll/ transaction
I-10/ Papago	2	New	2010 2020	10.7 12.6	~1200 ~1100	$2.87 $2.44
L-101/ Pima & Price	1	New	2010 2020	22.5 22.5	~780 ~790	$2.72 $3.94
US 60/Superstition & I-10/ Maricopa	1	Conversion	2010 2020	25.9 25.9	~800 ~920	$2.48 $2.79
SR-51/ Squaw Peak	1	Conversion	2010 2020	15.8 15.8	~730 ~740	$3.98 $4.37
L-202/Red Mountain	1	Conversion	2010 2020	9.2 9.2	~840 ~860	$2.09 $2.62

The overall fiscal feasibility results are summarized in Table 7-5. The "conversions" show net annual revenues from $5 to $11 million, lower because of their shorter operating periods and higher projected violation rates. The "new" facilities show net annual revenues from $11 to $20 million, higher due to more available capacity and longer trips made on these longer corridors. All five candidates appear to be fiscally viable as they show that construction and toll system implementation could be self-funded via toll revenue bonds, although Pima/Price would require a varying bond payment schedule to accommodate lower initial revenues. From this, the evaluation concluded that there are five strong candidates for Value Lanes in the MAG area network.

Table 7-5
Recommended HOT Case Fiscal Feasibility Results Summary

Alternative [Type]	Year	Annual Toll VMT	Average Estimated Net Annual Revenues	Estimated 30-year Bond* that could be funded	Estimated Construction Costs**	Estimated Toll System Implementation Costs	Total Costs** to Build Value Lanes
I-10/ Papago ***[new]***	2010 2020	54M 53M	**~$19.5M** **~$16.5M**	**~$175M** **~$150M**	$66M +$13M	$9.3M +$1.3M	**$75M** **+$14M**
L-101/ Pima & Price ***[new]***	2010 2020	56M 57M	**~$11.5M** **~$14.8M**	**~$100M** **~$130M**	$82M --	$38.3M --	**$120M** **--**
US60/ Superstition & I-10/ Maricopa ***[conversion]***	2010 2020	39M 52M	**~$9.9M** **~$11.3M**	**~$90M** **~$100M**	-- --	$20.0M --	**$20M** **--**
SR-51/ Squaw Peak ***[conversion]***	2010 2020	13M 15M	**~$5.1M** **~$6.8M**	**~$45M** **~$60M**	$30M --	$14.8M --	**$45M** **--**
L-202/Red Mountain ***[conversion]***	2010 2020	22M 26M	**~$5.5M** **~$6.0M**	**~$50M** **~$55M**	-- --	$8.1M --	**$8M** **--**

*Government-backed bond
** Excludes funded HOV construction, includes new HOV lane and connector costs

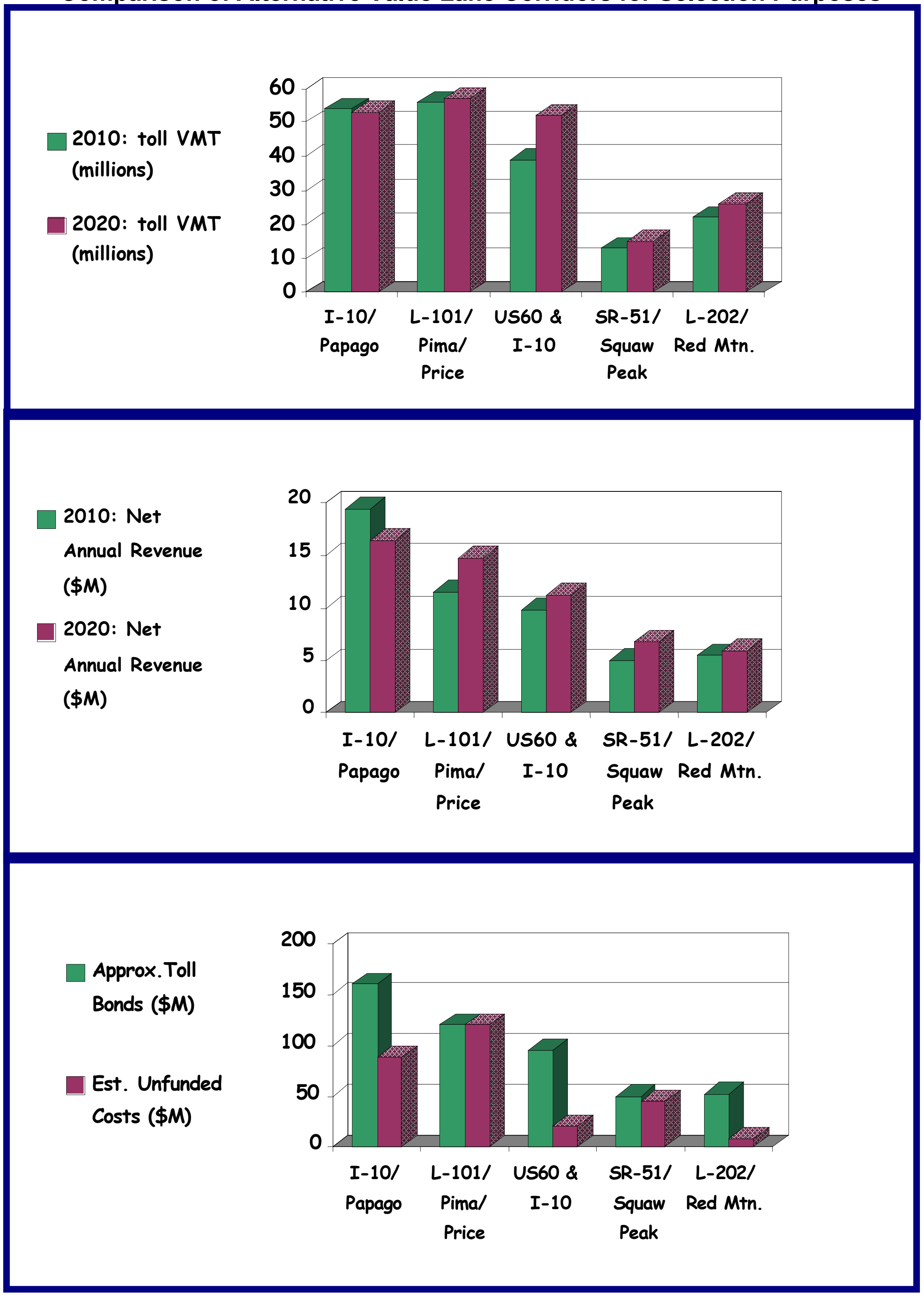
7.3 Evaluation of Alternative Demonstration Project Value Lane Corridors

To select a recommended demonstration project from these five viable alternatives, simple evaluation criteria were developed. Specifically, the criteria used to prioritize these five alternative candidates were:

- "New" lanes were given higher priority as they have no other funding source and are less controversial, therefore, they are more likely to gain acceptance from stakeholders and the public.
- High toll vehicle miles traveled (VMT) received a high priority as this is a measure of trips moving from the general-purpose lanes into the Value Lanes, which is the desired result (e.g., to use the spare capacity in the HOV lanes).
- High priority was awarded to those corridors with the highest revenue potential above their construction costs.

The VMT, net annual revenues, and estimated toll revenue bonds versus construction costs for each of the five alternatives are all shown graphically in Figure 7-6.

Figure 7-6
Comparison of Alternative Value Lane Corridors for Selection Purposes



To develop a priority ranking from these data and the criteria described above, a score was developed as shown in Table 7-6. The "New vs. Conversion" ranking is an arbitrary score that elevates the new candidates as shown in the table. This is not so much a "scoring" but a recommendation for HOT Lanes feasibility. The VMT and Extra Revenue rankings are directly measured from the VMT and revenue, above the construction costs given previously.

Table 7-6
Priority Ranking of the Candidate Demonstration Project Value Lanes

SCORE:	I-10/ Papago	L-101/ Pima/Price	US60 & I-10	SR51 Squaw Peak	L-202/ Red Mtn.
New vs.Conversion Ranking	20	20	10	10	10
VMT Ranking	5.4	5.7	4.6	1.4	2.4
Extra Revenue Ranking	7.1	0.0	7.5	0.5	4.4
Total:	**32.5**	**25.7**	**22.1**	**11.9**	**16.8**
RANK=	***1***	***2***	***3***	***5***	***4***

Conclusion

The conclusion of the fiscal feasibility study is that there are five viable corridors for potential Value Lanes that have been identified and evaluated. If there were to be a demonstration project to prove the concept and to establish acceptance, then the I-10/Papago between 79th and 3rd Avenues would be the highest ranking candidate.

7.4 Operational Evaluation of Recommended HOT Lanes Demonstration Project

The other aspect of the recommended HOT lanes Demonstration Project is the overall operational viability of the freeway and the HOT facility. As with the operational evaluation of the existing conditions in Section 7.1, the operational evaluation of the recommended HOT lanes as well as the mixed flow lanes, on the I-10 freeway are summarized in Table 7-7 for years 2010 and 2020 for the AM and PM peak periods. This table shows that the HOV lanes have significant spare capacity to accommodate toll payers when the facility is evaluated in a HOV-only scenario (i.e., the left-hand scenario in Table 7-7). Also, as there is congestion in the general-purpose freeway lanes, the implication that motorists would be willing to pay tolls to use the available HOV capacity. The other scenario identified in Table 7-7 (on the right side) is when the facility is evaluated as a HOT lane facility and toll-payers are allowed to use the spare capacity.

Table 7-7
Operational Evaluation of Recommended HOT Lanes Demonstration Project
(from MAG model results special runs)

	2010			2020		
	2010vlanemod_101000 (Gilbert)	2010I10demo_011502_20 (Blkcnyn)		20vlaneenh4_newmod_b_091801 (Gilbert)	20I10demo_012202_50 (Blkcnyn)	
	I-10 HOV base	I-10 HOT demo 20 cents/mile	difference HOT - HOV	I-10 HOV base	I-10 HOT demo 50 cents/mile	difference HOT - HOV
am peak period						
Corridor GPL & HOV VMT	732,353	770,134	37,781	864,140	899,795	35,655
Corridor GPL & HOV Delay	10,096	9,064	-1,032	24,164	20,652	-3,512
Corridor GPL VMT	340,385	337,130	-3,255	380,082	375,072	-5,010
Corridor GPL Delay	5,839	5,055	-784	14,016	11,688	-2,328
Corridor HOV Lane VMT	36,866	87,952	51,086	57,503	104,290	46,787
Corridor HOV Lane Delay	25	490	465	825	1,502	677
Regional Toll trips	0	10,105	10,105	0	11,240	11,240
Regional HOV trips (Shared Ride)	24,951	24,145	-806	44,311	43,515	-796
HOV\HOT travel time (peak dir)	10.46	13.48	3.0	21.02	19.99	-1.0
HOV\HOT travel time (offpeak dir)	10.09	10.09	0.0	10.97	10.97	0.0
GP Lane Travel time (peak dir)	26.22	23.78	-2.4	46.06	39.82	-6.2
GP Lane Travel time (offpeak dir)	13.63	13.55	-0.1	14.13	13.86	-0.3
Toll (dollars per mile)(peak dir)	0.00	0.20	0.2	0.00	0.50	0.5
Length of Toll Segment (peak dir)	0.00	9.97	10.0	0.00	10.86	10.9
Regional VMT	17,822,154	17,827,428	5,274	22,481,118	22,488,704	7,586
Regional Delay	234,326	228,597	-5,729	374,032	360,958	-13,074
pm peak period						
Corridor GPL & HOV VMT	864,259	898,215	33,956	1,012,435	1,046,466	34,031
Corridor GPL & HOV Delay	9,775	8,543	-1,232	17,794	14,678	-3,116
Corridor GPL VMT	377,812	370,197	-7,615	415,713	409,675	-6,038
Corridor GPL Delay	6,307	5,164	-1,143	10,321	8,094	-2,227
Corridor HOV Lane VMT	56,905	102,082	45,177	85,977	133,698	47,721
Corridor HOV Lane Delay	200	305	105	1,205	1,121	-84
Regional Toll trips	0	9,561	9,561	0	11,450	11,450
Regional HOV trips (Shared Ride)	36,761	35,884	-877	72,122	71,017	-1,105
HOV\HOT travel time (peak dir) *	12.07	12.19	0.1	24.32	17.70	-6.6
HOV\HOT travel time (offpeak dir)	10.43	10.09	-0.3	11.67	10.97	-0.7
GP Lane Travel time (peak dir)	23.32	20.46	-2.9	31.93	26.92	-5.0
GP Lane Travel time (offpeak dir)	17.27	17.04	-0.2	17.89	17.28	-0.6
Toll (dollars per mile)(peak dir)	0.00	0.20	0.2	0.00	0.50	0.5
Length of Toll Segment (peak dir)	0.00	9.97	10.0	0.00	10.87	10.9
Regional VMT	21,914,034	21,924,404	10,370	27,522,702	27,522,928	226
Regional Delay	267,660	264,767	-2,893	434,411	429,385	-5,026

2010 & 2020 tolls on I-10 from approximately 83rd Ave to Central Ave only
Selected Corridors were 18, 20 & 21
*hovflag=6,8,14 (wb); flag=5,7,13 (eb)
*fwyflag=600,800,1400 (wb); flag=500,700,1300 (eb)

This table provides various measures of the operational performance of the planned HOV lanes versus the demonstration project HOT lanes. Of particular interest are the corridor vehicle miles traveled (VMT) and minutes of demonstrated Delay (during the 3 hour peak period being modeled). The VMT and Delay is shown for the I-10 corridor's general-purpose lanes (GPL), the HOV/HOT lanes, and the sum of the two types of lanes on the corridor. In addition, the travel times are shown for the general purpose lanes and the HOV/HOT lanes. These are highlighted in green, gold and blue colors, respectively, in Table 7-7.

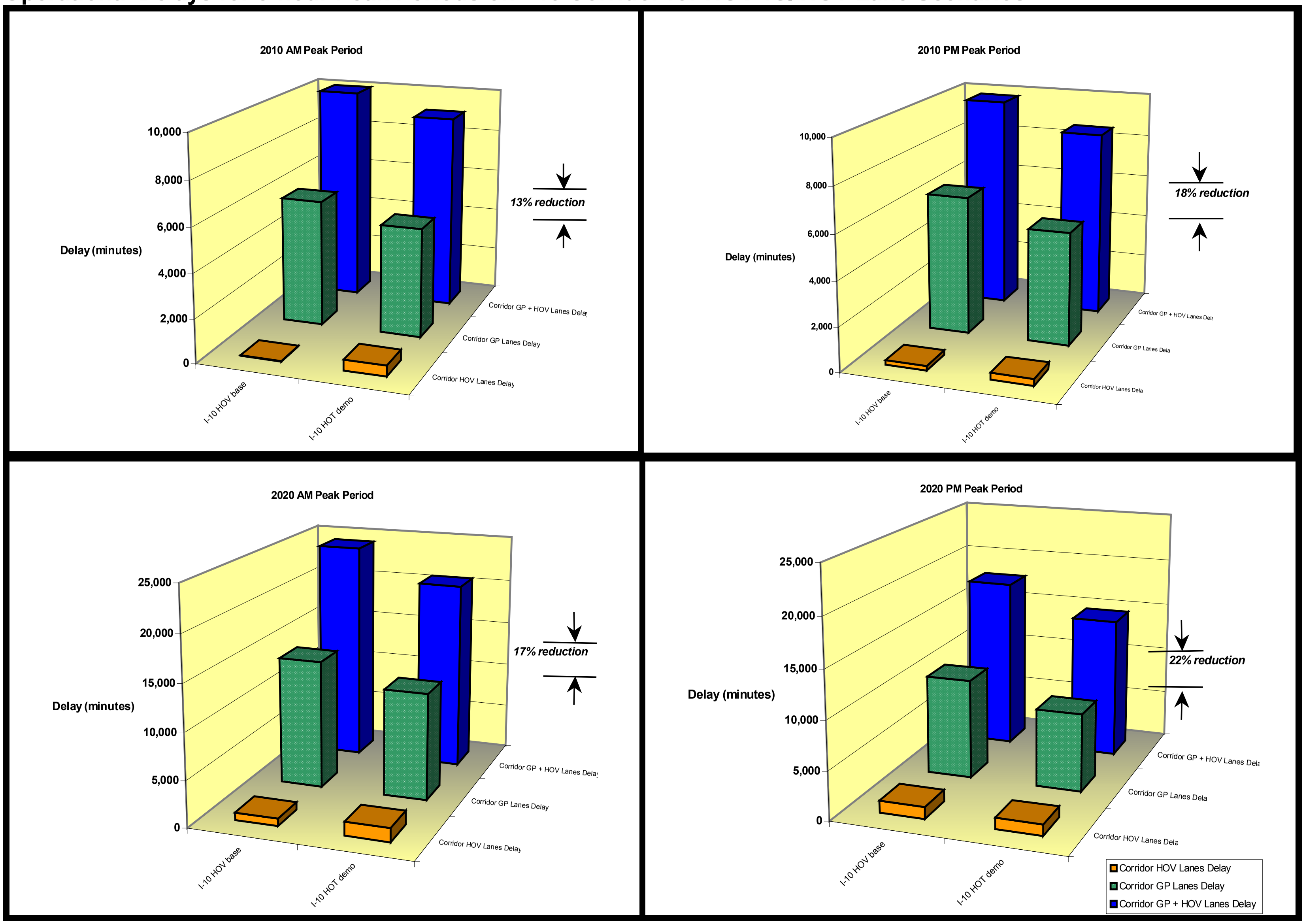
Of operational performance interest is that the VMT in the HOT lanes nearly doubles from that in the HOV scenario. This is expected since a new lane is being added to the capacity. And, the general-purpose VMT drops somewhat implying less congestion in these lanes.

In addition, as highlighted in aqua in Table 7-7, the corridor travel time for the general-purpose lanes is reduced in all cases. The general-purpose lanes' travel time in 2010 is reduced between 2 and 3 minutes (between 9 and 13%) for the AM and PM peak periods. And, in 2020 the general-purpose lanes' travel time is reduced between 5 and 6 minutes (between 13 and 15%) for the peak periods.

This improvement in the general-purpose lanes is even more evident in the Delays that are plotted in Figure 7-7. The colors correspond to the highlighted colors in Table 7-7. The diagrams in Figure 7-7 show the Delays in 2010 and 2020 in each of the HOV and HOT lane configurations for the HOV/HOT lanes, for the general-purpose lanes and for the sum of the two types of lanes. Here we see that the Delays are slightly increased in the HOV/HOT lanes, but the Delays in the general-purpose lanes are reduced significantly. Specifically, the corridor general-purpose Delays in 2010 are reduced 13% in the AM and 18% in the PM. And, these same corridors' Delays in 2020 are reduced 17% in the AM and 22% in the PM.

As shown in Table 7-7, the freeway operation evaluation shows the HOT lanes to be a "win-win" situation in that more motorists are accommodated on the HOT facility with only a slight degradation of the level of service in the HOT lanes, while also shortening the period of congestion on the general-purpose freeway lanes.

Figure 7-7
Operational Delays for 3-hour Peak Periods on I-10 Corridor for HOV vs. HOT Lane Scenarios



SECTION 8: EXPRESS BUS SERVICE AND PARK-AND-RIDE LOTS

The operation of a system of High Occupancy Vehicle (HOV) Lanes throughout the Phoenix metropolitan area will ensure continued mobility and a high standard of reliability into the future for all categories of HOVs, including express buses. Based on forecasts from the MAG regional model, traffic congestion will continue to worsen on the area's freeway system as the Phoenix metropolitan area continues to grow in size. In addition, the frequency of freeway incidents and traffic accidents will continue to grow in proportion with the growth in traffic volumes, making the freeway system less reliable than it is today. Without the availability of preferential lanes, HOV vehicles, including express buses, will bog down in traffic and will not be an attractive alternative to driving alone.

The concept of developing an area-wide system of express bus services that operate from "freeway close" park-and-ride lots and can strategically use a full system of HOV lanes is not unique to the MAG Region. Express bus service can be an attractive, speedy and reliable commute option if it can be largely segregated from congested mixed-flow freeway traffic lanes, as has been proven in Houston, Minneapolis, Pittsburgh, Los Angeles and the San Francisco Bay Area, among other major urban cities.

8.1 Current and Planned HOV Express Bus Service in the Phoenix Metropolitan Area

The concept of developing an area-wide system of park-and-ride lots based on express bus services for the MAG Region evolved in the late 1980's and early 1990's. An aggressive expansion of the system of express bus services (and a parallel expansion of the system of park-and-ride lots) was formally adopted as part of the 1994 High-Occupancy Vehicle Facilities Policy Guidelines and Plan for the MAG Freeway System (prepared for MAG, ADOT, and RPTA). The information in this report was then formally adopted as part of the MAG Long-Range Transportation Plan (1998 and updates) These adopted plans established a phasing for the implementation of new express bus services and the development of park-and-ride lots.

The adopted Regional Transit Plan calls for an integration of the express bus system into the metropolitan area’s transit fabric. This will be accomplished by designing express bus routes that originate at strategic park-and-ride lots, along all major freeway travel corridors, and interconnect with a centerpiece fixed guideway system (and local bus services) at on-line transit stations along I-10. Mode-to-mode transfers would occur at intermodal station sites both on and off the freeways. If operated effectively, the bus-rail concept with direct transfers at on-line stations can create a "seamless system" of transit that affords a high level-of-service to passengers. Given the projections of worsening freeway congestion and increased roadway incidents in the future, this "composite" service concept can compete well with solo commuting by automobile, especially for long distance trips in excess of 12 miles in length.

The RPTA and MAG have recently updated the Planned System of Express Bus Routes for the Phoenix metropolitan area. Figure 8-1 contains an area-wide map showing the envisioned system of express bus service, as well as existing and planned park-and-ride lots from which they will originate. A full system of 26 express bus routes is included in the RPTA/MAG Express Bus Plan.

As shown by Figure 8-1, the geographic coverage of the express bus service is very extensive and is oriented to primarily serve long distance commute trips from outlying portions of the metropolitan area to the central Phoenix area. As shown, the majority of the express bus routes (25 out of 28) are destined to central area destinations such as downtown Phoenix or the State Capital. In order to provide adequate levels-of-service, peak period headways on express buses are envisioned to range between 10 to 30 minutes between buses for any one route. In the central area, on-line transit stations will eliminate the need for buses to exit the freeway to reach passenger transfer points.

8.2 System of Park-and-Ride Lots and On-Line Transit Stations

A system of twenty-four existing and proposed park-and-ride lots is located primarily along the radial freeways that serve the metropolitan area. The park-and-ride lots are designated at the locations listed in Table 8-1 and are shown on the areawide map in Figure 8-2. The total estimated cost of the park-and-ride lots is approximately $90 million, an average of over $3 million per lot. Ideally, a park-and-ride lot should include exclusive ramps from the lot directly to HOV lanes to minimize travel time. The exclusive ramps should be considered in the site evaluation and design of each park-and-ride lot and the design of the HOV lanes in the vicinity of the lot. Depending upon the right-of-way cost for a specific park-and-ride site, exclusive ramps to the HOV lane might be constructed as part of the construction cost allocated for the park-and-ride lot.

If the development of exclusive ramps at a park-and-ride site cannot be warranted, sponsoring agencies will coordinate with ADOT to develop sites that are "freeway close" and have reasonable access to/from regular freeway ramps. For park-and-ride sites that are more remote from the freeway system, a specific bus routing plan will be developed that minimizes vehicle travel time to and from the nearest freeway ramps.

Table 8-1
Express Bus System Facilities
MAG Long Range Transportation Plan (20 Years)

FREEWAY	PARK-AND-RIDES
I-10	Litchfield Road 79th Avenue (Existing) Warner Road* Pecos Road
I-17	Happy Valley Road Bell Road (Existing) Metro Center
Loop 101 (Agua Fria)	51st Avenue Glendale Avenue Camelback Road*
Loop 101 (Pima)	Scottsdale Road Cactus Road
Loop 101 (Price)	Apache/Broadway
Loop 202 (Red Mountain)	Gilbert Road
Loop 202 (San Tan)	Price Road Val Vista Drive
SR 51 (Squaw Peak)	Shea Boulevard (Existing) Bell Road
US 60	Mesa Drive Gilbert Road (Page/Ash) Power Road (Superstition Springs Mall)
Other Locations	Grand Avenue/Bell Road (Sun City) Grand Avenue/59th Avenue

* Expected to change to nearby location

Figure 8-1
Park and Ride Lot Locations and Planned Express Bus Service

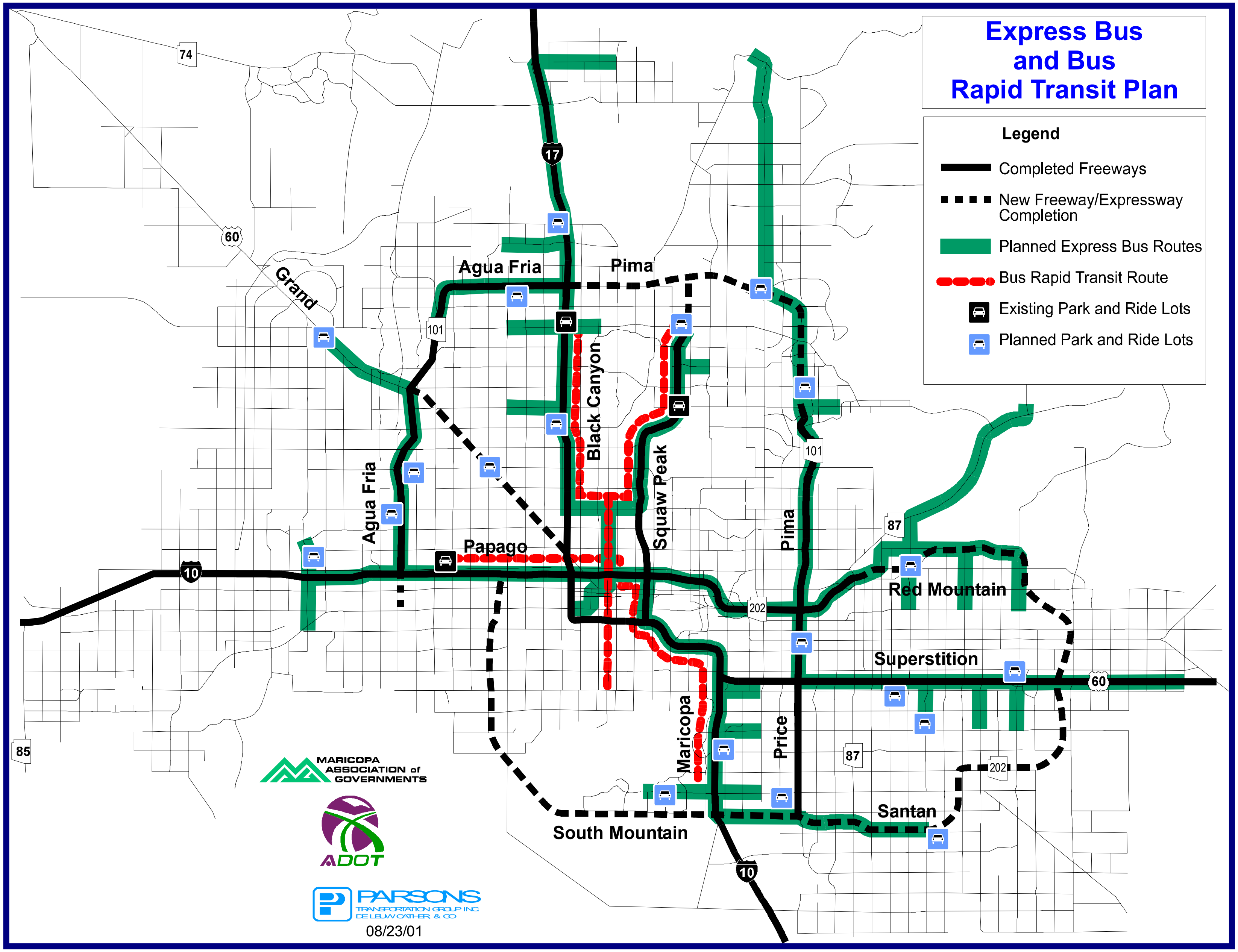
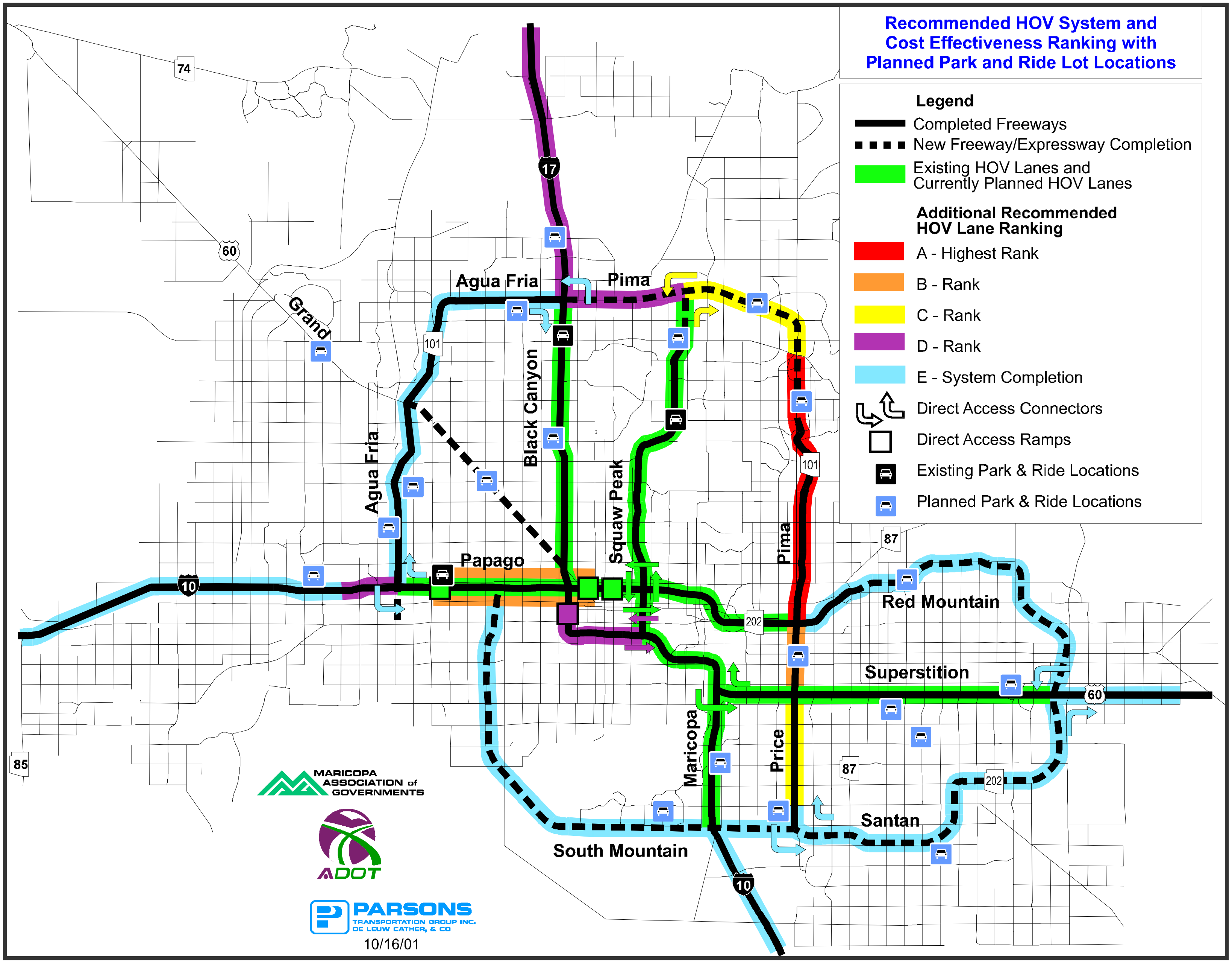


Figure 8-2
Planned Park-and-Ride Lot Locations



SECTION 9: DEMAND MANAGEMENT AND ENFORCEMENT

This section presents an overview of the demand management programs/strategies needed to ensure success of an HOV system. In addition, value pricing facilities are also addressed relative to their viability as a demand management technique. Finally, the need for proper enforcement of both HOV and Value Lane facilities is also discussed relative to its purpose of ensuring the operational integrity of the MAG Region transportation system.

9.1 Demand Management Options

Travel demand management (TDM) programs and policies are being used throughout the country to encourage greater use of HOV's and alternative commuting modes. TDM involves a variety of techniques focused on managing the demand on transportation facilities by encouraging single-occupant commuters to use an HOV or shifting to less congested travel periods, or by removing trips from the transportation system altogether. Thus, TDM programs generally promote ridesharing and transit use, alternative work schedules, parking management and pricing programs, and peak period spreading. Policies may also focus on deterrents to single-occupant driving and growth, land use, and zoning controls. The following discussion presents an overview of the above strategies. Table 9-1 lists the techniques often used with each strategy.

Ridesharing

Assisting commuters to form carpools and vanpools is the major focus of most ridesharing programs and a variety of marketing efforts can be used to promote ridesharing. In addition, ride matching services can either be provided at the regional level, within a specific geographic area, or by individual employers.

Project Marketing

Project marketing should be applied on new openings for HOV facilities. Marketing provides potential users an understanding of why the HOV facility has been implemented, what it is intended to accomplish, how it will operate and who may use it. This form of marketing is particularly important in the days just before and after a new HOV lane opens.

Encouragement of Flextime

Flextime promotion is a voluntary promotional effort to encourage employers and employees to work an extended or staggered work period so that not all demand uses the roadway network at the same time. Flextime promotion has been most beneficial in areas where demand spikes sharply with the regular commuting hours.

Table 9-1
Supporting Programs and Policies*

General Strategy	Techniques
Regional Rideshare Programs	• Ride matching services • Part-time, casual, and real-time carpooling • Vanpool programs • Employer outreach activities • Marketing and public information
Guaranteed Ride Home Programs	• Regional programs • Employer-based programs
Parking Management and Parking Pricing	• Preferential parking for HOV's • Pricing strategies • Parking cash out programs
Employer-Based Programs	• In-house transportation coordinators • Information dissemination • Company ride matching, vanpool, and guaranteed ride home programs • Subsidizing transit use • Subsidizing transit services • Transportation allowances • Preferential parking for HOV's • Parking pricing strategies • On-site amenities • Incentives for HOV use • Disincentives for driving alone
Growth Controls, Land Use Policies, Zoning Ordinances	• Growth management legislation and policies • Urban growth boundaries • Trip reduction ordinances • Adequate public facilities ordinance • Impact fees • Comprehensive plans and land use policies • Zoning ordinances and land use controls • Transit-oriented developments • Site design requirements

* Source: HOV System Manual

Guaranteed Ride Home Programs

This TDM program provides commuters who take transit or rideshare with backup transportation in the event of an emergency or change in work departure time. A regional agency, local group or employers could offer ride home programs.

Preferential Parking and/or Parking Pricing

These strategies include preferential parking for HOV's and parking pricing strategies to encourage HOV use. Parking management programs can be developed for specific regions, activity centers, or at specific employment sites.

Employer Programs

Employers have implemented various programs to encourage their employees to use HOV's or other modes of travel in order to minimize drive-alone trips. The above efforts have usually been undertaken in response to federal, state and local regulations, or to address a site-specific issue. Employer programs generally include the items mentioned above, as well as financial incentives to encourage HOV/transit use and minimize single occupant driving.

Growth Controls, Land Use Policies, and Zoning Ordinances

Several growth controls, land use and zoning policies may be used to encourage the use of HOV's and the viability of HOV facilities. Local governments generally have the authority to approve and enforce zoning ordinances and site-specific design requirements. These policies might include limiting parking, encouraging pedestrian and transit friendly design.

Most of the above TDM programs have been considered in areas where HOV facilities are part of the transportation infrastructure.

9.2 Additional HOV Operational Management Strategies

The analysis of the HOV system presented earlier in this report shows that the current HOV system is evolving from individual lanes to a system of HOV facilities that will provide one or more corridors within each section of the MAG Region. Most of these projects are single lanes that will begin to approach their operational capacity in future years. Given this scenario, a series of strategies is suggested to ensure success of the HOV system. These operational management strategies are presented below.

Usage Thresholds

Volume thresholds should be considered when assessing the need to change occupancy requirements or the operations of HOV facilities. The basis for HOV usage thresholds is typically governed by how effective the lane is in responding to peak period traffic conditions. Outside of the peak period, the justifications for HOV or general-purpose capacity are usually not warranted. There is also a range of anticipated values that any HOV lane operation should fall within. On the low end there should be enough demand that the lane does not appear empty to the motoring public. The minimum value should not be critical on day one, but should be met within a few years. On the high end, the lane should not be allowed to reach its operational capacity, or the traffic flow will be congested and operate no better than any other lane. If the lane reaches capacity in the peak hour, demand will expand into adjacent hours, mirroring freeway operational behavior. These conditions need to be considered when applying usage thresholds as a project opens and matures.

- *Minimum Thresholds*: The minimum threshold for lane use should provide the appearance of vehicles in sight within an HOV lane during the periods when adjacent lanes are congested. Otherwise, the lane will not appear adequately used and suffer from “empty lane syndrome”. For the MAG Region, the minimum operational threshold should be 600 peak hour vehicles.

- *Maximum Thresholds*: The peak capacity of a freeway lane ranges from approximately 2000 to 2200 vehicles per hour. As congestion builds on a freeway facility, the capacity of a freeway lane falls from its optimal volume. This condition can also occur on HOV lanes if demand exceeds the HOV lane capacity. When there is not any travel time advantage in the HOV lane, there is no incentive to use the facility. It is recommended that the maximum operational capacity threshold for the MAG Region HOV system be 1700 vehicles per lane in the peak hour.

Hours of Operation

Hours of HOV facility operation vary from continuous 24-hour operation to peak-period operation. About half the HOV facilities in the country use 24-hour operation and the other half use peak-period operation. Strong supporting reasons can be found for both approaches. The peaking characteristics of the MAG HOV system support the use of peak period operation of the HOV system.

Eligibility Requirements

Eligibility requirements during peak hours can be modified to best balance HOV demand to the lane’s capacity. Throughout the country, most HOV facilities start out, or are reduced, to 2+ facilities because opening day volumes in most corridors are insufficient to justify a 3+ restriction. This holds true for all of the new project openings in the MAG Region. As HOV demand increases in future years, one method of managing the demand on an HOV facility, if it starts to approach the maximum threshold, is to change the eligibility requirement during peak conditions.

Major Capacity Increases

Another means of addressing a facility with too much demand is to provide additional capacity (i.e. a second lane throughout the congested portion of the freeway corridor). Though this improvement can result in significant costs, freeway corridors such as I-10 that serve the downtown area and are projected to be operating over capacity in the near future may justify this type of investment.

Project Specific Transportation System Management (TSM) Treatments

Demand can be managed through site-specific improvements that either help encourage or discourage use. TSM treatments are usually focused on isolated locations along the HOV lane or system. Excessive demand can be addressed through re-striping or adding a second HOV lane for a short distance, minimizing access to the facility (i.e. providing dedicated access points, rather than continuous access), or, where direct access locations are provided, metering the HOV access ramp the same way general-purpose access ramps are metered. Inadequate demand may be addressed through rethinking HOV beginning and ending treatments, and changing the geometrics to provide smoother flows where the HOV lane may be impacting general-purpose operation. Enforcement efficiency could be enhanced through the addition of more enforcement areas (see subsection 9.4). Improved signage could also help to alleviate or better direct HOVs to/from the HOV facility.

Value Pricing Demand Management

Another means of addressing both under-utilized and over-utilized HOV facilities is value pricing. For under-utilized facilities, value pricing allows the opportunity for single occupant vehicles to use the facility for a fee or toll, thereby using the excess capacity and removing the "empty lane syndrome" concern. Similarly, for over-utilized single lane facilities, providing a second HOV lane may remove the over-utilization issue, but may result in insufficient volumes to fill both lanes. Value pricing again offers the opportunity for single occupant vehicles to utilize the excess capacity in the second lane. The fee or toll for the single or lower occupant vehicles can be established to sufficiently utilize the lane, while still maintaining a high level of service or travel time advantage over the adjacent general-purpose lanes. As discussed earlier in this report, a physical separation of the Value Lanes from the general-purpose lanes would need to be provided to ensure the operational integrity and enforceability of the lanes.

Access

Access to freeway HOV facilities can be accomplished via direct access, continuous access along the freeway mainline or designated access at specific locations. The MAG HOV system uses both direct and continuous access to its HOV facilities. This type of HOV access concept appears to be working well and it is recommended that it be maintained as the HOV system is expanded. However, for corridors that may be considered for Value Lane operation, it will be necessary to create a physical separation between the general-purpose lanes and the Value Lanes with designated access locations at approximately two-mile intervals along the corridor. This type of Value Lane access concept is necessary to ensure the operational integrity of the Value Lanes, simplify enforcement and properly collect fees/tolls from the single-occupant vehicles.

9.3 Strategy Recommendations

Based on experiences elsewhere and anticipated issues currently facing the MAG HOV system, the following strategy recommendations are proposed for consideration and are presented in Tables 9-2 and 9-3. Table 9-2 details a series of strategy recommendations that address HOV lane under-utilization, over-utilization and access. Table 9-3 presents proposed strategy applications.

9.4 Enforcement Needs

HOV and Value Lane facilities' operational concepts must be enforceable and must include provisions for enforcement. Various enforcement techniques and apprehension strategies are available. It should generally be a goal of the operator and enforcement agencies to meet a 95 percent compliance rate (i.e., five percent violation rate). To accomplish this, design provisions should be included that address the specific enforcement strategy recommended. If conventional on-site enforcement is the selected strategy, design criteria should include either continuous shoulders suitable for enforcement or designated enforcement areas at high visibility locations. These locations should minimize enforcement personnel requirements and maximize efficiency. Designated mainline freeway enforcement areas should be 14 feet wide and 1300 feet long to provide for adequate acceleration/deceleration.

Enforcement is the critical factor in the successful operation of both HOV and HOT lanes. The role of an effective HOV/HOT enforcement program is to ensure that operating requirements, including vehicle-occupancy levels, are maintained to protect travel timesavings, to discourage unauthorized vehicles and to maintain safe traffic operational characteristics of the HOV/HOT lanes. Travel timesavings for HOT/HOV lane users is critical to success of these lanes. Without timesavings, HOV usage would decline and HOT lane viability would diminish to a point where they would no longer be financially viable. Visible and effective enforcement promotes fairness and maintains the integrity of HOV lanes resulting in acceptance among users and nonusers.

Based on experiences across the country in assessing the compliance of their HOV facilities, the most effective compliance strategy is to ensure the facility is enforceable and that violation fines are sufficiently high. Areas such as California have fines in excess of $270 for violating an HOV facility.

Arizona's Department of Public Safety's data indicates that the violation rate on the MAG Freeway System HOV lanes varies from a low of 20 percent to a high exceeding 50 percent. Recent legislative action resulted in fines being raised to a maximum of $200 plus court costs. ADOT will add additional signage to freeways to emphasize the amount of the fine to aid in higher compliance and serve as a visual deterrent. Ultimately, however increased visibility of DPS personnel and the issuance of citations are key to reducing violations. If commuters realize that enforcement personnel are not or cannot adequately enforce the HOV and potential HOT lanes, then the operational integrity of these facilities will be comprised. Increased enforcement provisions including adequate law enforcement personnel are paramount in the design and operation of both HOV and HOT lane facilities and must be included in the DPS budget if implementation is to be successful.

Based upon the California and Texas HOT lane operations, Arizona should establish a goal for the operator and enforcement agencies to meet a 95 percent compliance role, i.e., a 5 percent violation role. To accomplish this goal, design provisions should be included to address specific enforcement strategy including onsite enforcement opportunities.

If conventional on-site enforcement is the selected strategy, design criteria should include either continuous shoulders suitable for enforcement or provide designated enforcement areas at high visibility locations. These locations should minimize enforcement personnel requirements and maximize efficiency and safety. Designated mainline freeway enforcement areas should be 16 feet wide (typical) and a minimum of 1300 feet long to provide adequate acceleration and deceleration.

Table 9-2
Strategy Recommendations

Issue	Recommendation	
Under-utilization (relates to peak periods only)	Option	Identify project candidates before opening, and examine what mix of strategies can best address the shortfall below 500/600 vph. Pursue voluntary strategies aggressively in advance of opening Promote and market new and expanded transit services and rideshare matching service. Set up mandatory action contingency plan.
	Option	For projects in the first year of operation: Monitor and report lane use Aggressively pursue TDM and project marketing measures Promote transit services. Pursue TSM actions capable of being performed by maintenance forces. Set up strategy action contingency plan.
	Option	For projects not reaching the threshold of peak hour use within one year of opening, pursue the following mix of actions: Reduce hours of operation to peak hour/direction only. Implement value pricing. Extend lane treatment (if forecasts show higher use will result); reduce eligibility to 2+ from 3+.
Over-Utilization	Option	Allow peak hours to reach capacity and fringe peaks to fill up. Take TSM actions only to smooth out demand hot spots along the lane.
	Option	Pursue TDM measures while monitoring use. Examine the potential impacts of over-utilization relief associated with any projects in the corridor or vicinity that would alleviate the problem.
	Option	Consider a corridor- or region-wide transition to raise occupancy requirements in combination with other actions.
	Option	Provide another HOV/Value Lane.
	Option	Consider value pricing.
Access	Option	Monitor and reassess hot spot access locations to determine if problems can be cured through modest TSM actions.
	Option	For problem access locations, assess relocation or replacement with direct access (if a freeway/freeway connector).

Table 9-3
Recommended Applications for Specific Strategies

Strategy	Recommended Application
TDM marketing/flextime	Place targeted emphasis on TDM marketing with respect to the HOV system implementation and operation. Use HOV lane projects as an incentive to further TDM actions.
Project marketing	Initial marketing (two to six months before/after) is needed for all new projects or project extensions in each corridor. Ongoing marketing is also needed with focus on specific actions that will enhance the operational success and performance of the HOV facility in attracting specific transit and rideshare markets that are most likely to be mode shift candidates.
Setting occupancy restrictions	Occupancy restrictions should be set for 2+ for initial project openings. Where demand is anticipated to outstrip capacity within a five-year period for more than six hours/day, project marketing should refer to this restriction as interim with a specific target year when occupancies are likely to be raised or other strategies considered.
Raising occupancy restrictions	Raising occupancy restrictions should be performed on a test or demonstration basis on one candidate corridor. A number of signing modifications will be required, and based on results of the demonstration; guidelines should be prepared for any future corridors. Consistency in occupancy restrictions should be preserved at the corridor level and not necessarily at the regional level.
Hours of operation	Hours of operations should be preserved at peak periods based on current levels of use and anticipated demands. However, separate hours of operation may be prescribed for higher occupancies during peak periods if consistent within a corridor or larger geographic area.
Value Pricing	Regional thresholds for value pricing and warrants are needed, both from an operational and a design perspective. The need to segregate toll-paying users from others presents technical, institutional and policy impediments that require careful consideration.
Project specific TSM treatments	The current HOV program does not provide for minor capital improvements to the HOV system. The need for these treatments will increase in future years as the system matures. A threshold of two percent of the construction budget per year is recommended to address TSM improvements on all projects once they have opened.

9.5 Enforcement Features

Enforcement of HOV and HOT lanes requires both intrusive and non-intrusive techniques. The use of video monitoring, violation photo enforcement and violations collection systems can reduce congestion and maximize operational characteristics and user safety. This approach is more effective if combined with highly visible and stringent police enforcement. The key to user compliance involves consistent enforcement supported by high fines, judicial application and extensive public education.

Other factors integral with these techniques include:

- Effective HOV and HOT violation signing.
- High levels of enforcement visibility.
- Adequate DPS (police) staffing.

- HOV operational hours.
- HOT operational hours (usually 24 hours).
- HOV/HOT lanes design is compatible with general purpose lanes design.
- Careful selection of ingress/egress points.

SECTION 10: HOV IMPLEMENTATION

With the recommended HOV system now defined, it is necessary to establish a means of ranking the additional HOV facilities beyond the existing and planned (i.e., adopted) HOV system. The cost effectiveness ratio provides a means of ranking the implementation of the recommended HOV corridors. Those corridors with the best (lowest) cost-effectiveness ratio would appropriately have the highest ranking for implementation. Given these factors, the recommended ranking for the additional HOV lanes, based upon cost effectiveness, is shown in Table 10-1. Similarly, the ranking for HOV connectors (freeway-to-freeway and direct access ramps) are shown in Table 10-2.

However, the implementation plan should also take into consideration a few other factors in addition to the cost effectiveness ratios. Other related projects that are planned for construction should be examined, as these projects may lead to additional cost savings in some of the recommended HOV segments. For example, if the mainline of a freeway is to be widened by a lane in the near future, a recommended HOV segment on the same portion of the freeway could be constructed at the same time, since building both projects together would be less expensive than constructing them separately. For that reason, an HOV segment could be pushed up on the ranking schedule. A related project could also be required to provide the needed connectivity for a recommended HOV segment, pushing that segment back on the ranking list. It would not be wise to construct a recommended HOV segment at the end of a freeway that dead-ends into another freeway (such as SR-101 south into I-10) without having the HOV connectors built. Without connectors, every vehicle in the HOV lane would have to merge into regular traffic lanes, which would be problematic, especially in heavy traffic.

Most importantly, the HOV implementation plan must also take into consideration the sufficiency of available construction funds versus time. Additionally, the HOV implementation plan and the actual HOV priorities that led to the creation of that plan should be reassessed on a five-year basis, with special recognition of evolving area demographics. A future plan should consider revised HOV rankings, the availability for HOV funding, synergies with other construction projects, and the cost economies of those other projects.

Table 10-1
Summary of Additional HOV Lanes
Characteristics of Proposed MAG HOV Systems

	Corridor	Segment	Segment Length (miles)	Cost Effectiveness Total Cost (millions)	Cost Effectiveness Value $/hr saved	Cost-Benefit Ranking
Recommended New HOV Lanes (Post 2007)	SR-101 Pima	Frank Lloyd Wright to SR-202	14.2	$50.6	$1.82	A
	I-10 Papago	79th Ave to 3rd Ave	8.4	$64.9	$3.25	B
	SR-101 Price	SR-202 (Red Mountain) to US-60	3.5	$12.5	$4.76	B
	SR-101 Price	US-60 to Chandler Blvd	5.7	$20.3	$8.97	C
	SR-101 Pima	SR-51 to Frank Lloyd Wright	6.7	$23.8	$9.73	C
	I-10 Papago	Agua Fria River to SR-101	3.6	$13.4	$10.45	D
	I-17 Black Canyon	I-10 (Papago) to I-10 (Maricopa)	6.5	$64.6	$12.21	D
	SR-101 Pima	I-17 to SR-51	6.8	$24.4	$12.48	D
	I-17 Black Canyon	SR-74 (Carefree Highway) to SR-101	9.0	$32.2	$14.08	D
	I-17 Black Canyon	Desert Hills to SR-74 (Carefree Hwy)	4.0	$14.3	$14.26	D
	Subtotal [A - D Ranked Lanes]		**68.4**	**$321.0**		
	SR-101 Price	Chandler to SR-202 (Santan)	1.1	$3.8	$20.97	E
	SR-101 Agua Fria	I-17 to 67th Ave	5.4	$19.2	$24.32	E
	SR-202 Red Mountain	SR-101 to SR-87 (Country Club)	3.6	$12.8	$24.66	E
	I-10 Papago	SR-85 to Agua Fria River	16.0	$59.5	$27.04	E
	SR-101 Agua Fria	US-60 (Grand) to I-10	9.7	$34.5	$31.42	E
	SR-101 Agua Fria	67th Ave to US-60 (Grand)	10.4	$37.1	$76.05	E
	Total [All New Recommended Lanes]		**114.6**	**$487.9**		
HOV Lanes Funded in Current Program	I-10 - Maricopa	Ray to Chandler Blvd	0.5	N/A	N/A	FY 2001
	SR-51 - Squaw Peak	I-10 to Shea Blvd	9.4	$42.6	N/A	FY 2003
	US-60 - Superstition	I-10 to Val Vista	12.0	$127.3	N/A	FY 2001
	Total [Funded Lanes]		**21.9**	**$169.9**		
HOV Lanes Planned but not Funded	SR-51 - Squaw Peak	Shea Blvd to SR-101	6.7	$23.8	N/A	Planned
	US-60 - Superstition	Val Vista to Power Road	4.1	$43.5	N/A	Planned
	US-60 - Superstition	Power Road to SR-202	2.1	$22.3	N/A	Planned
	Total [Unfunded Lanes]		**12.9**	**$89.6**		
	Grand Total		**149.4**	**$747.4**		

Table 10-2
Summary of HOV Freeway-to-Freeway Connectors
Characteristics of Proposed MAG HOV Systems

	Freeways Connected	Proposed Connections		Total Cost	Cost-Benefit Ranking
		From	To	(millions)	
Recommended HOV Connectors (Post 2007)	SR-101 - Pima SR-51	East South	South East	$20	C
	I-10 - Maricopa I-17	East West	West East	$50	D
	Total [2020 Priority Connectors]			**$70**	
	SR-101 - Agua Fria I-10 - Papago	North East	East North	$50	E
	SR-101 - Agua Fria I-17	West South	South West	$50	E
	SR-101 - Price SR-202 - Santan	North East	East North	$20	E
	SR-202 - Santan US-60 - Superstition	South East	East South	$20	E
	Total [All Planned Connectors]			**$210**	
Connectors Funded in Current Program	I-10 - Maricopa US-60 - Superstition	North East	East North	$33	FY 2001
	I-10 SR-51	South North	North South	$26	FY 2004
	Total [Funded Connectors]			**$59**	
Recommended HOV Access Ramps		Washington & Jefferson	I-17	$50	
	Grand Total [All Connectors/Ramps]			**$319**	

SECTION 11: HOT IMPLEMENTATION

A number of topics have been addressed during the study regarding implementation of HOT or Value Lanes in the MAG region. These issues include:

1. Equity and Social Justice
2. Regulatory Requirements
3. FHWA Value Pricing Program Requirements
4. Funding Sources
5. Monitoring Plan
6. Public Communications Plan
7. Demonstration Project Implementation Study

These HOT implementation topics are extensively discussed in the following seven subsections.

11.1 Equity and Social Justice Issues

Equity issues arise from the imposition of a toll for highway travel when such travel has generally been without toll. The incidence of the toll and how the money is used needs to be examined to determine if the toll is fair across income groups. Generally, the issue is considered most important for lower income groups because of their more limited ability to pay. About five percent of the respondents to a 1999 survey of 500 licensed drivers in Maricopa County expressed a concern that HOT lanes were not fair because the poor would be less able to afford their use or that HOT lanes were a violation of the "public" road philosophy. From an economic viewpoint, however, HOT lanes are a win-win situation. First, the HOT lanes would improve level of service in the general freeway multiuse lanes by diverting SOV drivers, with the benefits reaching beyond those paying the toll. Second, the current methods of financing "public" roads (gas tax and sales tax) have more equity problems than HOT lane tolls because of their regressive nature. Third, HOT lanes involve choice (i.e., one can always choose to travel in the toll-free multiuse lanes). For these reasons, the equity analysis is primarily focused on how the money raised by the toll is spent.

Based on the study's 1999 survey of licensed drivers, there are related equity and social justice issues, such as the perception of "paying twice" for the use of the road: once in the form of gasoline tax and again with tolls. But the most frequently given reason for disapproving of HOT lanes, however, was simply the imposition of a fee on a highway. Some respondents also felt that the extra capacity of the HOT lanes should be provided for all motorists if the lanes are part of a public highway. This section reviews these issues from the perspective of the following:

- Evaluation of distribution of user costs,
- Possible uses of net revenues, and
- Discussion of mitigation alternatives.

11.1.1 Evaluation of User Cost Distribution

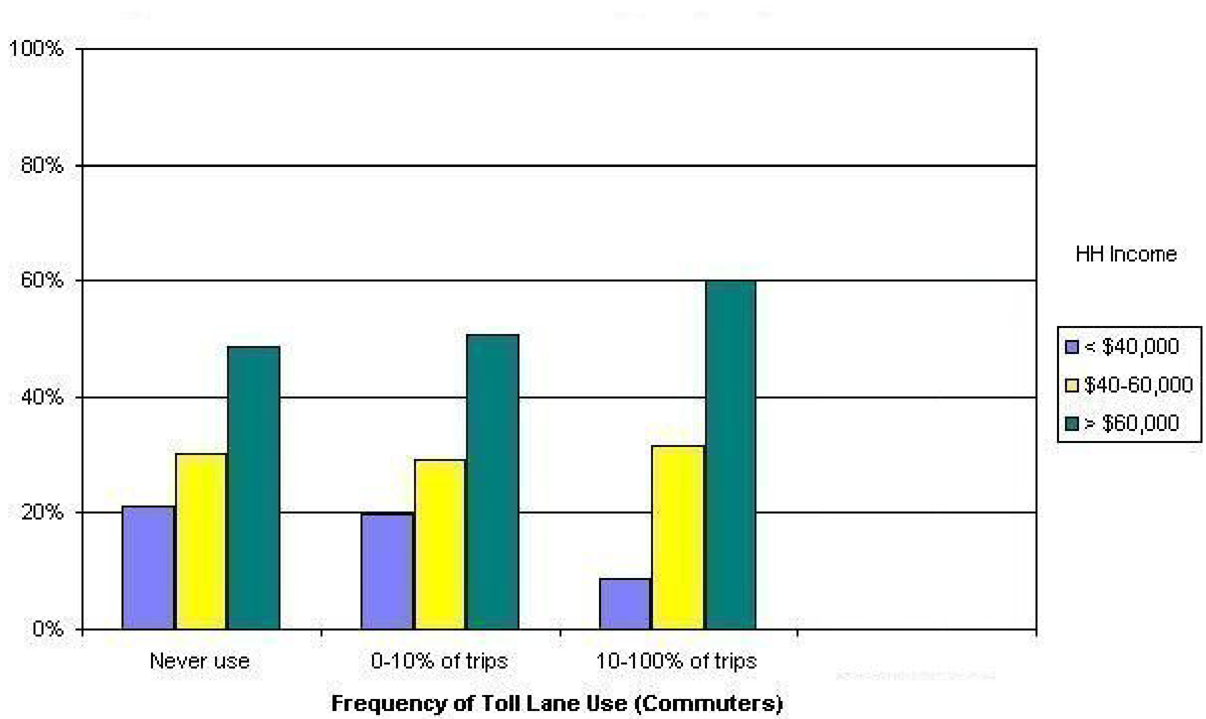
Users can be divided into categories by frequency of use and further subdivided by income. Figure 11-1 illustrates the profile of SR-91 Express Lanes users, who are expected to be similar to local HOT lane users because of roughly comparable incomes. Figure 11-2 presents similar data contrasting the most frequent users with non-users, while Figure 11-3 compares the 1990 household income distributions for the City of Riverside, located at the “home” end of SR-91 Express Lanes corridor and Maricopa County.

The SR-91 data suggest that the expected average toll in 2020 of $2.44 to $4.37 (depending on which HOT lane alternative is considered) would be paid by users of all three income classes, but more frequently by those with higher incomes. That is, higher income commuters would use the lane more frequently, but all classes would use it some of the time. Figure 11-1 indicates that about 10% of those making between 10% to 100% of their commute trips in the SR-91 Express Lanes belonged to the lowest income class. In contrast, about 20% of those making 0% to 10% of their trips in the SR-91 Express Lanes belonged to the lowest income class. For SR-91, there was little variation in the proportion of the middle-income group by toll lane use, but increasing proportions of the highest income group with more Express Lane use.

Figure 11-2 displays these data in another way, but leading to the same conclusion for SR-91, and by implication for the MAG Region HOT lanes: all income groups will use the toll lane, but a greater proportion of higher income groups will use it more.

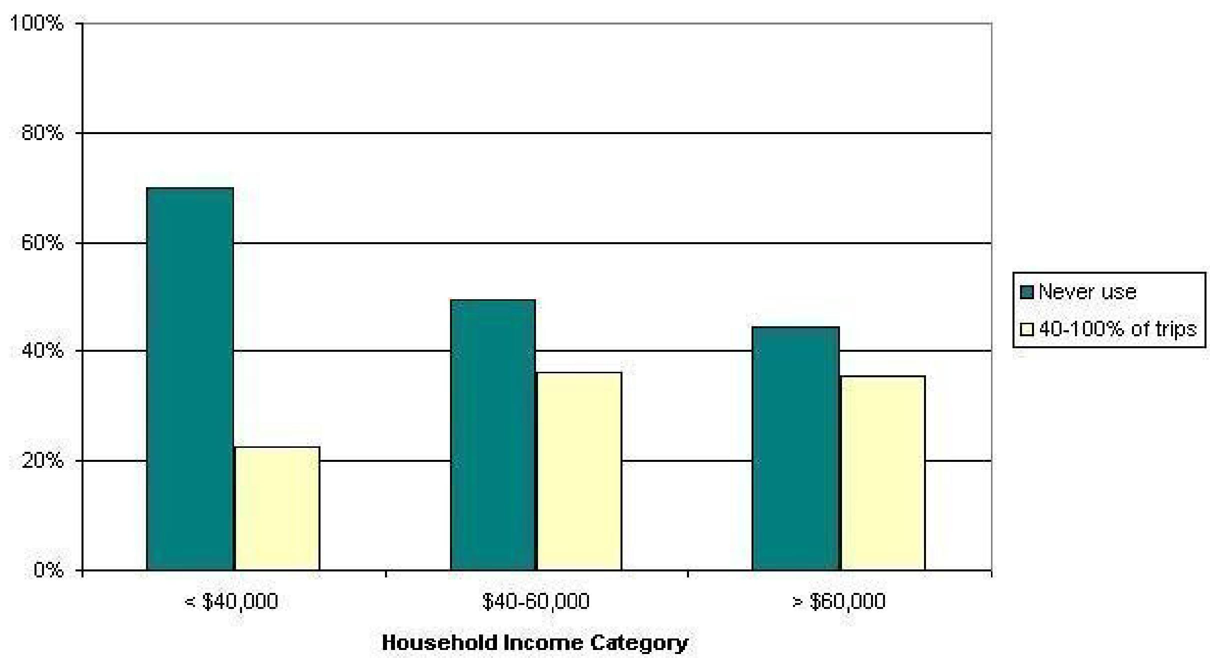
To consider how well the SR-91 Express Lanes data may apply to the MAG area, Figure 11-3 compares the 1990 income levels of the City of Riverside with Maricopa County. While not identical, the household income distributions are comparable. The City of Riverside has a slightly lower proportion of household incomes that are less than $40,000. Maricopa County has slightly lower proportions of household incomes over $40,000. Given that ten years have elapsed since the data were collected, today’s income distributions may compare differently, but the relationships between demographics/income levels per capita in the two states is difficult to compare as the 2000 Census information is not yet available.

Figure 11-1
Frequency of Toll Lane Use by Commuter Income
SR-91 Express Lanes, Fall 1996



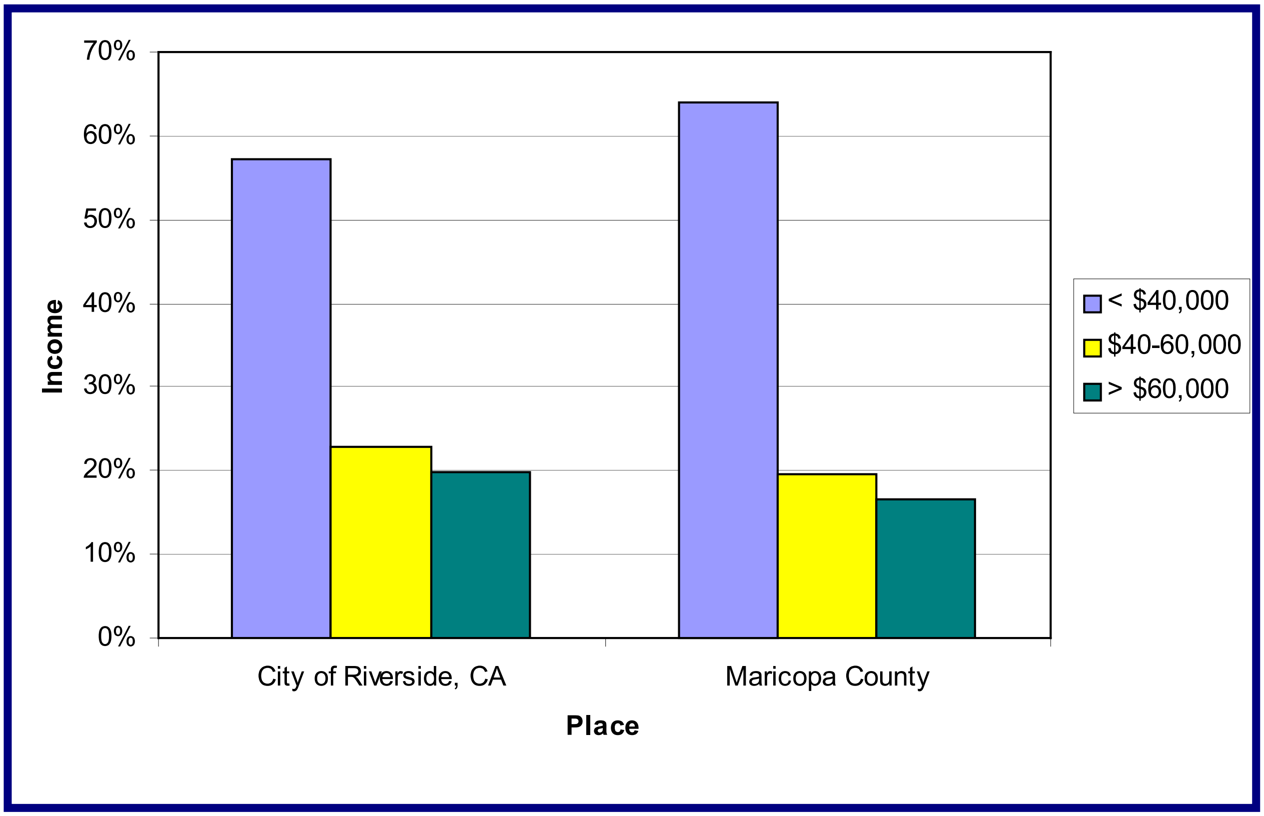
Source: http://www.ardfa.calpoly.edu/~jwhanson/newresults/sr91results.html, October 1999.

Figure 11-2
Commuter Income by Frequency of Toll Lane Use
SR-91 Express Lanes, Fall 1996



Source: http://www.ardfa.calpoly.edu/~jwhanson/newresults/sr91results.html, October 1999.

Figure 11-3
Household Income Distribution by Place
(1990 US Census)



11.1.2 Possible Uses of Net Revenues

Possible uses of the net revenues include the following categories:

Debt service for construction and conversion costs of HOT lanes,
Gas tax rebate to users,
Area transit and ridesharing service, and
Other transportation investments.

If all five of the potential HOT lanes alternatives are implemented, then total annual revenues after O&M costs are estimated to be around $55.4 million by 2020, rising from $51.8 million in 2010. Thus the amount of revenue likely to be available is relatively large over a period of 20 years, and would translate into a total bonding capacity of about $450 million in 2020. Construction and conversion costs are estimated to total about $282 million through 2020, potentially leaving about $168 million that could be used for other capital expenditures.

11.1.3 Discussion of Mitigation Alternatives

Debt Service For Construction and Conversion Costs of HOT Lanes

Because the total net revenue stream is large enough to pay for the additional construction/conversion costs of the toll lanes, this is a very logical use of the future funds. The HOT lanes would then be self-supporting for both construction and operation.

Gas Tax Rebate

A gasoline tax rebate would be one way of addressing the stated concern of paying twice for the roadway and would be required by current Arizona law. The current gasoline tax is 36.4 cents per gallon in Arizona—18 cents state tax and 18.4 cents federal tax. The current US stock vehicle average fuel efficiency is 20.4 mpg, which is projected to rise to 21.5 mpg by 2020. The stock values are on-road efficiencies for personal vehicles, fleet vehicles, and freight light trucks[1].

Using 21.5 mpg (to account for more personal vehicles using the HOT lanes), the cost of the rebate would be between three and six percent of the 2020 annual net revenues, with the range depending on whether only the state's gasoline tax was rebated or whether both the state and federal gasoline taxes were rebated. The rebate would reduce the bonding capacity for all five alternatives by a total of $15 to $30 million in 2020, the range again depending what portion of the gasoline tax was rebated. After paying construction and conversion costs, the remaining total bonding capacity for the five alternatives would be between $138 and $153 million.

Whether a rebate should be paid is largely a political decision. The term "paying twice" is really based on a misperception of how much is being paid relative to the cost of highways. With the assumptions above, the current federal and state gas taxes for light-duty vehicles in Arizona amount to approximately 1.7 cents per vehicle mile. As the effort to raise additional revenue for highway construction indicates, the current level of gasoline tax allows the state to fund little more than highway operation and maintenance expenses. Conversely, HOT lane revenues that are adequate to cover construction expenses are only slightly decreased by rebating the gasoline tax.

Area Transit and Ridesharing Service

Based on the fact that the poorest commuters are more likely to use the bus, support of increased area transit is recommended for a proportion of the revenues. About 36 percent of respondents mentioned the need for transit in response to Question 3 in the study's survey (the most important transportation problems in the Valley). The actual amount of revenue dedicated to transit should be based on the expected cost effectiveness of transit service options. Likewise, some trip reduction may be gained by additional support of ridesharing, but the cost effectiveness of specific proposals should be considered.

The revenues generated from other states Value Pricing demonstration projects are being used to fund new and expanded transit services. For example, new express bus service in the I-15

[1] Table 47. Light-Duty Vehicle Miles per Gallon by Technology Type, US Department of Energy, March 2001 [http://www.eia.doe.gov/oiaf/aeo/supplement/suptab_47.htm]

corridor in San Diego is being funded by the revenues from the Value Pricing demonstration project.

Other Issues

Other equity-related issues mentioned in the study's survey included the following:

> The extra capacity of the HOV lanes should be provided for all if the lanes are part of a funded public highway, and
>
> There should be no fees for the use of a highway.

Both of these issues have a similar response from a public policy perspective. Because of inflation and improving gasoline mileage, current levels of gasoline taxes and other motor vehicle fees are not enough to fund highway construction at the rate that traffic congestion is growing in areas like the MAG Region. As noted above, such fees at the state level are slightly more than the costs of maintaining the existing highway system. There are also environmental and social impacts to increased highway construction that reduce the feasibility and increase the costs of expanded highway construction. As a result, federal and state policies favor building highway lanes that increase the person-carrying, as opposed to vehicle-carrying, capacity of highways. HOV lanes that give a time incentive to ridesharing and transit are an important cornerstone of this policy.

Likewise, none of the respondents suggested that taxes should be increased to pay for expanded highways. Yet many noted the inadequacy of the existing freeways and the need for improvement. Consequently, federal and state policies are experimenting with the limited use of user fees to fund new construction, with HOT lanes currently being the most politically acceptable step. Value pricing also permits charging users more during the peak-period, which helps balance highway supply and demand though Congestion Management is more equitable than the "flat" and relatively low price of the gas tax.

11.2 Regulatory Requirements

The State of Arizona would need to establish specific enabling legislation to allow tolls on new or existing state or interstate roadways, as well as to enable an entity to perform toll collection (operate) on the new toll facility or HOT lanes (see existing State of Arizona privatization statues). This enabling legislation should consider the bonding against toll revenue by the owner of the toll facility or HOT lanes, prescribe standards for electronic toll collection and permit enforcement of toll collection requirements.

11.2.1 Establish Legislation for Toll Collection on State Highway Facilities

The State would need to consider establishing enabling legislation to permit tolls on state-owned roadways. This legislation will need to address the collection of tolls or revenue for the use and operation of equipment and facilities for travel that have been constructed, owned, operated or maintained by the toll authority. An example of similar legislation can be found in the State of California Streets and Highways Code, Bridge and Highways District Act, Section 27550, *et seq*., enabling a (bridge or highway) "district" to:

> "… study, construct, acquire, improve, maintain, and operate any and all modes of transportation within or partly outside the district, including, but not limited to, water

transportation; may join with any cities, counties, districts, or state agencies, or any combinations thereof, to study and to provide any such mode of transportation as may be deemed by the board to be reasonable and appropriate to provide or to assist in providing transportation within or partly outside the district; and may pay for or finance, in whole or in part, any such study and any such mode of transportation."

11.2.2 Establish Legislation for Formation of Toll Authority and Power

The State would need to consider establishing enabling legislation to permit the formation of toll authorities and respective powers to " study, construct, acquire, improve, maintain, and operate any and all modes of transportation" facilities used for the purpose of toll collection. A toll authority could consist of local, state, county, or city agencies organized as a single entity, a joint powers authority, or a district. Similar legislation has been enacted in the State of California Streets and Highways Code, Bridge and Highways District Act, Section 27000, *et seq*. This legislation prescribes the requirements for establishing a bridge or highway "district" as the toll authority consisting of a board of elected officials and to define its charter, covenants, by-laws and/or other governing rules and regulations.

Once established, toll authorities would need to define measureable objectives for toll operations and management, including toll collection business (financial) and enforcement rules, fiscal interoperability and reciprocity with other toll facilities, traffic safety enhancement, toll facility revenue generation and marketing objectives, enforcing vehicle registration and/or weight enforcement, and managing customer behavior. Most toll authorities have established agency policies and business rules from which to conduct toll operations in conjunction with state and local legislation.

11.2.3 Establish Legislation for Vehicle Code Statutes / Violations

The State would need to consider establishing enabling legislation to define vehicle code statutes as part of operating and maintaining toll facilities. In addition to vehicle codes and laws already established for public roadways, these statutes define the enforceable laws that specifically apply to toll facilities. These may include the erection of signs at each entrance to notify traffic that it is entering a toll facility, refusal of a registered owner's request to renew vehicle registration for failure to resolve toll violations and traffic fines/penalties and administrative fees for toll violations and evasion. An example of this legislation has been enacted in the State of California, Vehicle Code, Section 4770, *et seq*., Section 23300, *et seq.*, and Section 40250, *et seq.*

11.2.4 Establish (State/Regional) Technical Standards for Electronic Toll Collection

To promote traffic safety, efficient toll collection operations and maintenance and financial accountability, the State would need to consider establishing technical standards for electronic toll collection (ETC). These standards provide the uniform basis on which to competitively design and construct toll collection facilities and promote competition for toll equipment procurement, thus potentially reducing capital and recurring costs, and providing user (e.g., transponder tag) interoperability with other toll facilities for fiscal reciprocity between agencies. An example of this approach of using technical ETC standards can be found in the State of California's Title 21, Chapter 16, Articles 1 through 4, Section 1700 *et seq*., the Inter-Agency Group (IAG) automated vehicle identification (AVI) transponder standard in the Northeastern U.S., and the CEN AVI standard in Europe.

11.2.5 Establishment of Toll Evasion Enforcement Statutes and Procedures

To promote effective toll collection operations, appropriate toll violation enforcement statutes would need to be enacted to ensure fiscal viability. Along with the enabling legislation permitting toll collection, the State would need to consider establishing enabling legislation for toll violations and evasion collection procedures. This legislation and related violation enforcement system are keys to reduced toll violations, increased toll payment compliance, enforcing customer behavior and proper transponder tag usage. An example of a toll evasion enforcement statute/regulation involves vehicle registration renewal restrictions as currently implemented and enforced by toll agencies in the State of California. The California Vehicle Code, Section 4770 *et seq*., Section 23300 *et seq*., and Section 40250 *et seq*. define the toll evasion provisions and due process for pursuing and collecting from toll violators.

In this case, toll violations are subject to a civil penalty, and thus, are governed by the State of California civil administrative procedures provided by the Streets and Highway Code, Division 16, Section 27000 *et seq*. These procedures define the toll evasion penalties an agency can collect from a violator, including the original toll amount, administrative fees, process service fees, and collection fees and costs for civil debt collection. These procedures also define permissible violation detection and violator vehicle identification methods, violator notification requirements and time frames, payment collection process, violation contest and appeals processes, civil judgments and Department of Motor Vehicle (DMV) registration "holds" and which agencies or jurisdictions receive the violation fines.

11.2.6 Re-evaluation of Existing State Law

The State would need to also consider changing the following law to facilitate HOT lanes:

> 28-7749. Tax refund or credit
> A person who pays a toll to operate a motor vehicle on a roadway project that is constructed or operated pursuant to this article is entitled to and may apply for a refund or credit from the state for motor vehicle fuel license taxes, use fuel taxes or motor carrier fees paid while operating the motor vehicle on the roadway project. The director shall establish by rule the procedures for granting refunds or credits.

The law is predicated on the assumption that the State has enough money to pay for roads without use of toll revenue. Given the actual economic situation in which the State can afford slightly more than maintenance, such a rebate only encourages the State to refund money that it does not have. In addition, the law makes no distinction between federal and state gasoline taxes. Because the State cannot obligate federal gasoline taxes, the law would not likely survive a constitutional challenge. Also see the discussion in subsection 11.1.3 for the consequential loss in bonding capacity, should the demonstration project be charged for the rebate.

A review of the existing rebate provision may be necessary to reflect current fiscal realities, and in fact, the provision may be revised or deleted altogether.

11.3 FHWA Value Pricing Program Requirements

11.3.1 Implications for Arizona Value Lanes

The federal requirements outlined in the following subsection have the following implications for a potential Arizona DOT Value Lane program:

- Innovation in pricing strategies is desirable, with pricing varying by time of day and/or level of congestion.
- An initial project should be presented as the first step in applying value lanes to multiple corridors.
- A careful monitoring and evaluation program to identify and document the program effects, both positive and negative, is very important. This subject is discussed in Section 11.5.

11.3.2 Federal Requirements

Section 1216(a) of the Transportation Equity Act for the 21st Century (TEA-21, Public Law 105-178) authorized the Secretary of Transportation to create a Value Pricing Pilot Program by entering into cooperative agreements with up to fifteen State or local governments or other public authorities to establish, maintain, and monitor local Value Pricing Pilot Programs[2]. This program replaced the Congestion Pricing Pilot Program that was authorized by the Intermodal Surface Transportation Efficiency Act of 1991.

TEA-21 amended ISTEA Pub L. 102-240, 105 Stat. 1914, by providing that any value pricing project included under these local programs may involve the use of tolls on the Interstate system. This is an exception to the general provisions concerning tolls on the Interstate system as contained in 23 U.S.C. 129 and 301. Section 1216 (a)(5) of TEA-21 amends section 1012(b) of ISTEA by adding subsection (6) which provides that a State may permit vehicles with fewer than two occupants to operate in high occupancy vehicle (HOV) lanes if the vehicles are part of a local value pricing pilot program under this section. This is an exception to the general provision contained in 23 U.S.C. 102, that no fewer than two occupants per vehicle be allowed on HOV lanes. The Transportation Secretary is to report to Congress every two years on the effects of local Value Pricing Pilot Programs. TEA-21 continues the program through FY 2003.

The Congress has mandated this program as an experimental program aimed at learning the potential of different value pricing approaches for reducing congestion. FHWA had been seeking proposals to use value pricing projects to reduce congestion and promote mobility. Value pricing charges are expected to accomplish this purpose by encouraging the use of alternative times, modes, routes, or trip patterns. To this end, and to increase the likelihood of generating information on a variety of useful value pricing strategies, proposed projects, having as many of the following characteristics as possible, will receive highest priority for Federal support. Projects of interest include[3]:

[2] Value Pricing Pilot Program - FHWA Office of Transportation Policy Studies. April 4, 2001
[3] Federal Register Notice - Participation in the Value Pricing Pilot Program, October 5, 1998

1. Applications of value pricing which are comprehensive, such as area-wide pricing, pricing of multiple facilities or corridors, and/or combinations of road pricing and parking pricing.

2. Pricing of key traffic bottlenecks, single traffic corridors, or pricing on single highway facilities, including bridges and tunnels. Proposals to shift from a fixed to a variable toll schedule on existing toll facilities are encouraged (i.e., combinations of peak-period surcharges and off-peak discounts).

3. More limited applications of value pricing are also acceptable, including pricing on lanes otherwise reserved for high occupancy vehicles, known as high occupancy toll (HOT) lanes, or pricing on newly constructed lanes. Highest priority will be given to lane pricing proposals that cover multiple facilities and/or offer innovative pricing, enforcement, or operational technologies. In order to protect the integrity of HOV programs, the FHWA typically gave priority to those HOT lane proposals where it is clear that an HOV lane is underutilized and where local officials can demonstrate that a demonstration project would not undermine a long-term regional strategy to increase ridesharing. In addition, areas proposing HOT lane projects are encouraged to use revenues from the project to promote improved transit service or other programs that will encourage transit use and ridesharing.

4. Innovative time-of-day parking pricing strategies provided that the level and coverage of proposed parking charges is sufficient to reduce congestion. Parking pricing strategies, which are integrated with other market-based pricing strategies (e.g., value pricing) are encouraged. Parking pricing strategies should be designed to influence trip-making behavior, and might include peak-period parking surcharges, or policies such as parking cash-out, where cash is offered to employees in lieu of subsidized parking. Pricing of a single parking facility, coverage of a few employee spaces, or pricing of parking spaces in a small area, for example, are unlikely to receive priority treatment, unless they incorporate a truly unique element which might facilitate broader applications across local areas and states.

5. Projects with anticipated value pricing charges, which have the key characteristic that they are targeted at vehicles causing congestion, and they are set at levels significant enough to encourage drivers to use alternative times, routes, modes, or trip patterns during congested periods. Proposed projects, which contemplate value pricing charges and which are not significant enough to influence demand, such as minor increases in fees during peak-periods, or moderate toll increases instituted primarily for financing purposes, will be given low priority.

6. Projects are likely to add to the base of knowledge about the various design, implementation, effectiveness, operational, and acceptability dimensions of value pricing. The FHWA seeks information related to the impacts of value pricing on travel behavior (mode use, time-of-travel, trip destinations, trip generation, etc., by private and commercial trips); on traffic conditions (trip lengths, speeds, level of service); on implementation issues (technology, innovative pricing techniques, public acceptance, administration, operation, enforcement, legality, institutional issues, etc.); on revenues, their uses and financial plans; on different types of users and businesses; and on measures designed to mitigate possible adverse impacts and their effectiveness. These diverse information needs mean that the FHWA may fund different types of value pricing

applications in different local contexts to maximize the learning potential of the demonstration project.

7. Projects that do not have adverse effects on alternative routes or modes, or on low-income or other transportation disadvantaged groups. If such effects are anticipated, proposed pricing programs should incorporate measures to mitigate any major adverse impacts, including enhancement of transportation alternatives for peak-period travelers.

8. Projects that indicate revenues will be used to support the goals of the value pricing project and to mitigate any adverse impacts of the project.

9. While the FHWA was seeking proposals that incorporate some, or all of these project characteristics, these guidelines were intended only to illustrate selection priorities, not to limit potential program participants from proposing new and innovative pricing approaches for incorporation in the program.

10. Since this study was initiated, the FHWA has changed its policies related to the referenced Value Pricing Program and no longer provides funding for Demonstration Projects. In the light of this recent policy change, initiating a Value Lanes Demonstration Project in the Phoenix area will need to be delayed until such funding can be identified and secured.

11.4 Funding

11.4.1 Funding under the FHWA Pilot Program[4]

Funding for the FHWA Value Pricing Pilot Program were typically used to support pre-project study activities and pay for the implementation costs of value pricing projects. Costs eligible for reimbursement under Section 1216(a) of TEA-21 included the costs of planning, setting up, managing, operating, monitoring, evaluating, and reporting on local value pricing pilot projects. Recent changes in the Federal Highway Administration Value Lane Policy resulted in the deletion of program funding for continuing the opportunity to proceed with, and significantly reduces the near-term viability for a formal Pilot Project. Unless alternative sources of funding can be identified and secured, the pilot program decision to proceed may need to be delayed. The following are typical examples of specific costs that will need reimbursement:

Pre-Project Study Costs

- Impact assessment
- Modeling
- Development of monitoring/evaluation plans
- Public participation
- Market research
- Financial planning

[4] Value Pricing Pilot Program, FHWA, April 4, 2001.

Implementation Costs

- Costs associated with the implementation of a value pricing project, such as implementation of electronic tolling equipment, enforcement costs, costs of monitoring and evaluation and public participation.

- Costs of providing new or expanded transportation alternatives.

- Depending on the availability of funds, limited funds may be available to serve as a revenue reserve fund to provide assurance to toll authorities that a pilot test of value pricing would not jeopardize their bond covenants.

- Given the current authorization level of $11 million per year and 15 potential projects, funding tends to be limited to the pre-project costs and implementation costs of electronic tolling equipment, enforcement costs, costs of monitoring and evaluation, and the like.

11.4.2 Other Funding

Funding of the costs of adding a lane would most likely come from one (or both) of two other sources:

- A typical (and limited) federal-aid/local mix for ADOT highways, or
- Bonds backed by toll revenues.

Note: Alternative funding for a Value Lanes Demonstration Project will be needed as there are no available construction funds currently planned nor appropriated for this use.

11.4.3 FTA Funding Constraint on Value Lanes

At the present time, the Federal Transit Administration (FTA) has taken the official position that any HOV lanes constructed using FTA funds cannot be used for HOT or Value lanes. That is, tolls cannot be charged on HOV facilities funded by the FTA. A HOT lane project on I-25 in Denver is currently "on hold" due to the FTA position. During this study, the MAG HOV Committee members determined that, to date, FTA funds have not been used to construct the MAG Region's HOV lanes. Hence, this FTA constraint is not an issue at this time.

11.5 Monitoring Plan

The federal requirements above assume a comprehensive monitoring plan to generate information related to the impacts of value pricing on travel behavior. To gain understanding of travelers' reactions to value pricing and project features will require an extensive program of direct observations, surveys of corridor users, and impact modeling. It should include both pre-project data collection to establish a base line and periodic data collection efforts during the project to capture the effects. Suggested features of the data collection include the following:[5]

[5] Based on *Continuation Study to Evaluate the Impacts of the SR-91 Value-Priced Express Lanes, Final Report.* Prepared by Edward Sullivan, Cal Poly State University (San Luis Obispo), for Caltrans, December 2000.

- Observations of traffic conditions along the demonstration corridor and at some control sites distant from the corridor. Observations should include traffic counts, speeds, vehicle types, and vehicle occupancies.

- Observations of traffic volumes on selected ramps and speeds on parallel arterials and freeways.

- Observations of ridership on public transportation services and in organized rideshare programs serving the demonstration corridor.

- Travel surveys conducted to understand the characteristics of the demonstration corridor peak period commuters and their revealed travel behavior, including both longitudinal and cross-sectional observations.

- Opinion surveys to understand commuters' views about the project features and related public policies, over time, through the demonstration project.

- Analysis of accident rates and observation of traffic operational characteristics, especially weaving at the entrances and exits of the HOT lanes.

- In addition to these data collection activities, use should be made of the travel survey in modeling to determine price elasticities and travelers' value of time.

11.6 Public Communications Plan

As part of an implementation study, two types of outreach activities are described in the following two subsections. The third subsection below summarizes the proposed theme to be presented.

11.6.1 Stakeholder Interviews/Presentations

As a first step in the implementation study, we recommend that one-on-one interviews be held with up to 20 key stakeholders to garner support for a Value Lane project. Stakeholders will include representatives from local jurisdictions, environmental groups, business groups, elected officials, and agencies. The interviews play an important role in the overall process because they provide key players with an opportunity to speak more candidly about the project and their specific concerns.

The consultant team would coordinate with ADOT to determine potential interview participants. The team would be responsible for contacting potential interviewees to schedule interview appointments. To help focus the discussion, we would develop an interview questionnaire. We would conduct the interviews in person or by phone, using the standardized (and ADOT-approved) interview questionnaire. The interviews would be confidential. Aggregate results of the interviews would be reported in a summary document.

A key objective of the stakeholder interviews would be to find a project champion as well as to inform local political representatives of the likely political benefits and risks of the Value Lane proposals.

11.6.2 Public Forums

As a second step in the implementation study, public forums should be held. The study team would facilitate and graphically record the public forums at two stages in the study, with the locations of the forums depending upon the potential projects to be proposed. The forums would be designed to meet identified goals, with activities including, but not limited to, informational presentations, group discussions and individual feedback exercises. The informational video on value pricing, developed by the Humphrey Institute in Minneapolis, was used during this study and was useful as an educational tool in the public meetings. The team members will coordinate logistics and develop agendas and comment sheets to be used at the forums. The purpose and general format of these forums would be the following:

- Round I Forums: Preliminary Alternatives and Recommendations - The purpose of the first forum would be to present planning/development alternatives and recommendations for and community review. Participants would have an opportunity to provide feedback regarding the different alternatives and recommendations, and identify possible demonstration projects for further refinement by the project team.

- Round II Forums: Potential Demonstration Projects - The final forum would present potential demonstration projects for stakeholder and community review and input.

11.6.3 Public Outreach Message

The MAG Region is growing fast and its traffic is growing even faster.

Experts generally agree that the population will increase by 50 percent over the next 20 years, and travel will increase by 70 percent during that same time. The problem isn't just theoretical; in a late 1999 survey, 69 percent of residents said that traffic was a very important problem in the Valley. Traffic is growing; the question is: How best to deal with it?

The Region has an extensive and growing network of High Occupancy Vehicle (HOV) lanes in place. Regarded for 20 years as a transportation-management concept that offers multiple benefits, HOV lanes encourage ridesharing and raise vehicle occupancy, both reducing traffic in the general-purpose lanes and offering those who are willing to rideshare the benefit of a dedicated and often free-flowing lane. The lanes make the existing freeway system more effective and efficient through a simple concept: Move more people, rather than just more cars.

The MAG Region's first HOV lanes opened in 1988, and today over 50 miles of lanes exist, with most of the lanes located on I-10, State Route 202, and I-17. But although they enjoy broad public support, the lanes have not resulted in wholesale changes in the way people commute. Furthermore, societal norms chafe against the rigid day-to-day planning needed for a motorist to maximize his/her use of the HOV lanes.

Against this background, High Occupancy Toll lanes (or HOT lanes, for short) can best be described as new or existing HOV lanes that are opened to solo drivers for a fee. They can accomplish several goals:

- By filling up underutilized carpool lanes, they keep HOV lanes at their optimum utilization.

- By diverting some solo drivers from the adjoining general-purpose lanes, they help reduce congestion in those lanes.

- They generate revenue for transportation corridor improvements.

- They provide significant time savings and a reliable travel (premium) option to solo drivers who have a special need to reach their destination on time and are willing to pay a premium for the time savings and reliable travel privilege.

- Although results of a late 1999 survey on the HOT lane concept were split, they were consistent with the pre-construction and pre-education attitudes of motorists and residents in areas where HOT lanes have been built. Significantly, support for HOT lane projects grows markedly when a public education effort was undertaken to explain the project's benefits.

With continued focused education and workshops, public opinion and attitudes towards Value Lanes can shift. While the focus group participants were widely split on the idea of "HOT lanes," they approved of the idea of "express lanes" by a wide margin – even when told that the two concepts were identical.

These survey results, combined with the experiences of other HOV and HOT projects in the U.S., paint a surprisingly consistent picture: When the benefits of HOT lanes are properly explained and positioned as a new option rather than something forced upon the driving public, motorists tend to favor the flexibility and innovation of these projects.

11.7 Value Lanes Demonstration Project(s) Implementation Study

At the conclusion of the current study, ADOT officials and MAG will have a number of choices regarding Value Lane implementation. To take advantage of the potential benefits of implementing Value Lanes in the region, ADOT will need to take action. We suggest an implementation study to help guide these future actions. The study would provide guidance for the following steps:

Pre-implementation Phase:

- Selection of the demonstration project (presumably from the alternatives identified in Section 7),
- Identify and obtain legislative changes required for project (see subsection 11.2),
- Obtain funding for the demonstration project (see subsection 11.4),
- Conduct public outreach (see subsection 11.6),
- Develop plans and specifications to the project study report level,
- Select electronic system and operational concept,
- Develop relationship of demonstration project to an overall system,
- Develop monitoring and evaluation plan (see subsection 11.5),
- Conduct environmental review (if necessary),
- Establish concept of operations and maintenance for implementation, and
- Define toll system and other procurement features to bid level

Implementation Phase:

- Conduct bidding process and select contractors,

- Collect pre-project data,
- Construct in-house elements of system,
- Install toll and related equipment,
- Test toll system,
- Open demonstration project to traffic,
- Collect on-going data for monitoring and evaluation, and
- Evaluate effectiveness and impacts of project.

SECTION 12: ACTION PLAN

Upon completion of the Value Lanes Study, an Action Plan should be put into place by ADOT and MAG. The recommendations include the following actions:

Action Plan Items:

- Incorporate the HOV and HOT recommendations into new "draft" Long Range State and Regional Transportation Plans.

- Add a design concept report and environmental assessment to the MAG and 2007 ADOT Programs for Value/HOT lanes on I-10/Papago between 79th and 3rd Avenues (and/or on major segments of Pima/Price).

- Include funding in State and Regional Programs to study locations and design concepts for HOV connectors and ramps recommended in this update to the HOV Plan.

- Include funding in State and Regional Programs to conduct the next five-year update to the HOV Plan in FY 2007.

- Pursue public education on the need for an HOV/HOT system.

- Seek legislative changes needed to facilitate implementation of Value Lanes.

- Include Value Lane implementation using one or two Pilot Programs.

SECTION 13: CONCLUSIONS

In conclusion, this Value Lanes study provides the following findings, insights and recommendations.

The results of this study indicate that HOV and HOT Lanes, or Value Lanes, are feasible and a viable traffic management treatment option to maximize use of available mainline capacities for the Maricopa County area freeway network. Additionally, the concept of Value Lanes offer benefits to single occupant vehicles (SOV) drivers for a fee premium in exchange for trip travel time savings, reliable travel time and a less congested driving experience, as well as, a revenue generating source to fund Value Lanes operations and maintenance and other public transportation mode options.

The HOV lanes also enjoy strong support in the community. Seventy-nine (79) percent of respondents in the study's survey stated that they were familiar with the region's carpool lanes and had used them; 86 percent of those surveyed approved of the HOV concept, and a remarkable 66 percent said that they strongly approved of the concept. Additionally, nearly 75 percent of those surveyed agreed that more HOV lanes should be built on the region's freeways. This data supports plans to add HOV lanes.

While the general public and stakeholders have shown general interest and accept the concept of Value Lanes, it is recommended that focused Value Lanes education to the general public be continued over time and prior to implementation of the concept.

This concept of selling of excess HOV lane capacity for a fee to non-carpoolers (HOT lanes) has been identified as an approach to expand the use of the excess capacity in HOV lanes to serve a greater variety of users and generate additional revenue. A key consideration toward attracting toll-paying non-carpoolers to the HOT lanes is to ensure that smooth flowing travel conditions are maintained for all users at all times. Congestion or value pricing (i.e., adjusting the tolls for the HOT lane during periods of high traffic volumes) can be used to maintain these smooth flowing conditions. These two separate concepts are often intertwined. HOT lanes are a method to sell excess HOV lane capacity. Congestion or value pricing is a method to adjust the volume of non-carpoolers on the HOT lane to ensure smooth flowing traffic conditions by using price as the travel demand management control.

The State of Arizona's efforts to establish specific enabling legislation to allow tolls on new or existing state or interstate roadways, as well as to enable an entity to perform toll collection (operate) on the new toll facility or Value lanes (see existing State of Arizona privatization statues) will pave the way for project implementation. This enabling legislation will also provide for the bonding against toll revenue by the owner of the toll facility or HOT lanes, prescribe standards for electronic toll collection and permit enforcement of toll collection requirements.

For Value Lanes Demonstration Project programming and funding, ADOT and MAG need to use the projected 2010 and 2020 traffic demands as the basis to provide a case for secondary traffic demand management option as the Maricopa area HOV network is constructed and established. Value Lanes, as a secondary treatment, will give ADOT and MAG with a demand-based, traffic tool to manage available freeway mainline capacity while offering SOV drivers an alternative time saving, smooth travel option to the typical, congested experience. Congestion or value pricing (i.e., adjusting the tolls for the HOT lane during periods of high traffic volumes) can be used to maintain these smooth flowing conditions.

Finally, the Action Plan provides ADOT and MAG with a toolbox from which to use as a template to implement HOV lanes as a base treatment, and then introducing Value Lanes over time on those impacted freeway segments that exhibit chronic, peak period LOS E and F traffic conditions.

In conclusion, this Study and this Final Report identifies the Value Lanes “Blueprint” and Action Plan for ADOT and MAG to use as a time-phased, planning, implementation and operations guide to deploy Value Lanes in anticipation of the County’s traffic growth through the years 2010 and 2020, and beyond.

APPENDIX A

Survey and Results

FINAL CONCLUSIONS

The finding of this study indicate that HOV/HOT Lanes or Value Lanes are feasible and a viable traffic management treatment option to maximize available mainline capacities for the greater Phoenix are freeway network. Although, the general public and stockholders have shown interest and generally accept the concept of value lanes in lieu of gridlock conditions, implementation of the concept needs to be implemented overtime where HOV treatments are initially deployed concurrent with a marketing and education program for HOT Lanes. HOT Project programming needs to use the projected 2010 and 2020 traffic demands as the basis to provide the cure for secondary traffic demand management once the HOV network is established. This secondary treatment will provide ADOT and MAG with a dynamic traffic management tool to maximize mainline capacity while encouraging the traveling public to consider alternative travel options to the typical SOV selection.

March 24, 2000

Mr. Jon Green
Parsons Transportation Group Inc.
4701 Von Karman Avenue, Suite 300
Newport Beach, CA 92660

Dear Jon:

Enclosed please find a copy of the results from the recent survey Lawrence Research conducted for us on transportation issues in Maricopa County, Arizona. We have also enclosed an updated copy of aggregate results, cross tabulations, group tabulations, and an updated informal memo from us regarding some of our key findings from the results.

We hope the information is helpful. If you have any questions or need any further assistance, please do not hesitate to contact us.

Sincerely,

GEORGE T. URCH KELLY POFFENBERGER

Enclosure

PERSONAL/CONFIDENTIAL N = 500 Licensed Drivers 21+

Maricopa County

LAWRENCE RESEARCH
1450 N. Tustin Avenue, Suite 150
Santa Ana, California 92705

Project #9805
Time Started ______________
Time Ended ______________

Field: December 7-14, 1999
Random Digit / Predictive Dialer

Hello, I'm ______________________ of Lawrence Research, a national research firm. We're conducting a public opinion poll about issues in the Phoenix area. We're not selling anything. We'd just like your opinions about transportation and traffic. May I ask you a few questions? (IF NEEDED: This is a legitimate public opinion survey; it is not a sales call. Is now a good time to interview you?)

A. Are you a licensed driver in Arizona 21 years of age or over?

Yes (CONTINUE)
No (ASK FOR A LICENSED DRIVER OVER 21 IN HOUSEHOLD)

---

1. How long have you lived in Maricopa County?

Less than 3 years	10
3 years to less than 5 years	7
5 years to less than 10	15
10 years to less than 20	21
20 years to less than 30	19
30 years or more	29
[REFUSED]	*

---

2. When you think of problems facing the Valley and you could rate them on a scale from zero to ten -- where zero means **unimportant** and ten means **very important** -- where would you place transportation on this zero-to-ten scale?

Zero / One (Unimportant)	3
Two	1
Three	1
Four	2
Five	6
Six	5
Seven	11
Eight	18
Nine	12
Ten / (Very important)	39
[NO OPINION]	1

---

3. When you think of transportation issues and getting around, what do you consider the most important transportation-related problems facing people in the Valley today? (PROBE)

____

____

____

4. Do you use the Valley freeways to go to work, school or other such trips ... never, less than 20% of the time, 20% up to 50%, 50% up to 80%, or 80% of the time or more?

Never	17
Less than 20% of the time	23
20% up to 50%	19
50% up to 80%	17
80% of the time or more	24
[NO OPINION]	*

---

5. Have you ever heard of H-O-V lanes, or High Occupancy Vehicle lanes, also known as carpool lanes? (IF YES:) Have you ever used them anywhere in the Valley?

Heard / have used	79
Heard / have not used	17
Not heard of	3

---

6. H-O-V lanes are the lanes on the freeways which can only be used by vehicles having two or more occupants in them. Some people call them carpool lanes. They are built to help encourage carpooling and to speed express buses. From everything you've seen and experienced about H-O-V lanes, do you ... strongly approve, somewhat approve, somewhat disapprove or strongly disapprove of them?

Strongly approve	62
Somewhat approve	25
Somewhat disapprove	5
Strongly disapprove	6
[NO OPINION]	2

IF STRONGLY OR SOMEWHAT APPROVE, ASK: (N=432)

7. What are one or two of the reasons why you (strongly/somewhat) approve of H-O-V lanes? PROBE FOR MULTIPLE MENTIONS)

IF STRONGLY OR SOMEWHAT DISAPPROVE, ASK: (N=57)

8. What are one or two of the reasons why you (strongly/somewhat) disapprove of H-O-V lanes? PROBE FOR MULTIPLE MENTIONS)

9. At present, there are 42 miles of H-O-V lanes on Valley freeways. During the time period that H-O-V lanes are dedicated to carpools only, do you use the lanes ... never, less than 20% of the time, 20% up to 50%, 50% up to 80%, or 80% of the time or more?

Never	30
Less than 20% of the time	36
20% up to 50%	17
50% up to 80%	9
80% of the time or more	7
[NO OPINION]	1

10. Presently, over 40 miles of additional H-O-V lanes are planned for the Valley freeways. Do you feel that more H-O-V lanes should or should not be built?

Yes, should	73
No, should not	20
[NO OPINION]	6

11. Do you feel the H-O-V lanes are adequately used in the rush hour by carpoolers, or not?

Yes	46
No	40
[NO OPINION]	14

12. At present, H-O-V lanes may be used by anyone except during weekday morning rush hours -- 6am to 9am -- and evening rush hours -- 4pm to 6 pm -- when they are reserved for vehicles with two or more occupants. Which of these three choices comes closest to your own feelings about H-O-V lanes in the future?

We should keep things just as they are	63
We should eliminate the H-O-V requirement and open up H-O-V lanes for general use at all times	21
We should allow solo drivers to use the H-O-V lanes if they pay a fee	14
[NO OPINION]	2

13. Have you ever heard of H-O-T lanes, or High Occupancy Toll lanes? (IF YES:) Have you ever used tollroads or toll lanes anywhere in America?

Heard / have used	20
Heard / have not used	18
Not heard of	62

14. H-O-T lanes, or HOT lanes, which stands for High Occupancy Toll lanes, allow solo motorists to travel in the carpool lanes for a small fee, when unused space is available. Carpoolers would still be able to use the lanes at no charge and still maintain free-flow movement. HOT lanes are currently operational in San Diego and Houston. From everything you've heard and seen about HOT lanes, do you ... strongly approve, somewhat approve, somewhat disapprove or strongly disapprove of them?

Strongly approve	13
Somewhat approve	26
Somewhat disapprove	17
Strongly disapprove	30
[NO OPINION]	13

IF STRONGLY OR SOMEWHAT APPROVE, ASK: (N=199)

15. What are one or two of the reasons why you would (strongly/somewhat) approve of HOT lanes?
E FOR MULTIPLE MENTIONS)

IF STRONGLY OR SOMEWHAT DISAPPROVE, ASK: (N=237)

16. What are one or two of the reasons why you would (strongly/somewhat) disapprove of HOT
PROBE FOR MULTIPLE MENTIONS)

If HOT lanes are built, there are a number of possible ways that they can be used. I will read you a list of possibilities for these HOT lanes. For each one, please tell me whether you ... strongly agree, somewhat agree, somewhat disagree or strongly disagree. (READ IN RANDOM ORDER)

	Str Agr	Smw Agr	Smw Dis	Str Dis	[NO OPIN]
17. Base the price on the amount of traffic on the freeway at that particular time -- higher during rush hours and lower during off hours.	26	25	12	30	8
18. Operate the HOT lanes 24 hours per day.	32	19	15	30	5
19. Have a government agency build and operate the HOT lanes.	19	23	15	36	7

		Str Agr	Smw Agr	Smw Dis	Str Dis	[NO OPIN]
20.	Have a private company build and operate the HOT lanes.	14	19	16	44	8
21.	Construct the HOT lane with fewer entrances and exits than a typical H-O-V lane, making it an express lane.	31	29	10	22	8

22. If you are not carpooling and a HOT lane was available during rush hour, and you could save 15 minutes on a 45 minute commute at the cost of one dollar, would you use the HOT lane ... never, less than 20% of the time, 20% up to 50%, 50% up to 80%, or 80% of the time or more?

Never	34
Less than 20% of the time	21
20% up to 50%	12
50% up to 80%	12
80% of the time or more	19
[NO OPINION]	2

IF 20% OR MORE (CATEGORIES 3, 4 & 5), ASK: (N=214)

23. And if a savings of 15 minutes on a 45 minute commute would cost you two dollars, would you use the HOT lane ... never, less than 20% of the time, 20% up to 50%, 50% up to 80%, or 80% of the time or more?

Never	20
Less than 20% of the time	23
20% up to 50%	20
50% up to 80%	15
80% of the time or more	18
[NO OPINION]	3

IF 20% OR MORE (CATEGORIES 3, 4 & 5), ASK: (N=114)

24. And if a savings of 15 minutes on a 45 minute commute would cost you three dollars, would you use the HOT lane ... never, less than 20% of the time, 20% up to 50%, 50% up to 80%, or 80% of the time or more?

Never	22
Less than 20% of the time	25
20% up to 50%	23
50% up to 80%	14
80% of the time or more	16
[NO OPINION]	1

Here are some ways the collected revenues from the toll lanes might be spent. For each one, please tell me whether you ... strongly approve, somewhat approve, somewhat disapprove or strongly disapprove of spending toll revenues for that purpose. (READ IN RANDOM ORDER)

		Str App	Smw App	Smw Dis	Str Dis	[NO OPIN]
25.	To expand the freeway system in the Valley	58	22	5	13	2
26.	To make local street improvements	48	29	7	13	2
27.	To expand existing transit services	57	22	4	14	3
28.	To promote air quality improvements by reducing vehicle emissions and promoting telecommuting.	52	22	5	15	5

---

29. Here are the positions of two people, call them Smith and Jones. After I read them, please tell me whether you are ... strongly like Smith, somewhat like Smith, somewhat like Jones or strongly like Jones.

    Smith likes H-O-V and HOT lanes and wants more built. He figures even if he doesn't use them, others will and that will ease congestion on the general-use freeway lanes.

    Jones doesn't like H-O-V and HOT lanes. He says it is unfair to use taxpayer money to build them and then to charge people to use them.

Strongly like Smith	31
Somewhat like Smith	26
Somewhat like Jones	14
Strongly like Jones	24
[NO OPINION]	5

---

30. Let me now explain a concept called "dynamic value pricing." If HOT lanes are built, "dynamic value pricing" means the toll for solo drivers who use the HOT lanes will be based upon the amount of traffic on the freeway at that particular time. The price to use HOT lanes will go up during rush hours and down during off hours so that just the right number of drivers will use the HOT lanes but still keep traffic moving. Dynamic value pricing is currently operational in San Diego. Just your first impression, do you ... strongly approve, somewhat approve, somewhat disapprove or strongly disapprove of dynamic value pricing?

Strongly approve	17
Somewhat approve	33
Somewhat disapprove	13
Strongly disapprove	31
[NO OPINION]	7

And a few questions for statistical purposes...

31. Do you commute to work or school? (IF YES:) How long does it take you to commute to work or school each morning on average?

Yes / Less than 15 minutes	15
Yes / 15 to 29 minutes	23
Yes / 30 to 44 minutes	17
Yes / 45 to 59 minutes	6
Yes / 60 minutes or more	3
No, do not commute	35
[NO OPINION / REFUSED]	1

32.	What is the last year of school you have completed?	Less than high school........3 High school graduate........21 Some college/vocational........36 College graduate........28 Post-graduate degree........10 [REFUSED]........1
33.	Did you vote in the 1998 general election? And did you vote in the 1998 primary election?	Yes on both........58 Yes on general / No on primary........10 No on general / Yes on primary........2 No on both........29 [CAN'T REMEMBER / REFUSED]........1
34.	What is your age, please?	21-24........5 25-34........19 35-44........22 45-54........21 55-64........11 65 +........20 [REFUSED]........2
35.	And what is your current annual household income -- that is, the total for everyone in your household? (READ CATEGORIES IF NECESSARY)	Under $25,000........6 $25,000 - $35,000........10 $35,000 - $50,000........17 $50,000 - $75,000........18 $75,000 - $100,000........10 $100,000 - $150,000........7 Over $150,000........4 [REFUSED]........28
36.	What is your zip code?	_____ _____ _____ _____ _____
37.	Sex	Male........50 Female........50

That completes our interview. Thank you.

38. PHONE: ______/__________________________________

Thank you for talking with us today.

****

INTERVIEWER CERTIFICATION:

I have re-read this completed questionnaire and certify that all questions requiring answers have been appropriately filled in and that this interview has been obtained from the individual designated.

INTERVIEWER____ DATE____________________

NOTE: This interview is the property solely of Lawrence Research. Any attempt to duplicate or sell the contents constitutes an illegal act and is subject to prosecution.

MEMO

TO: Jon Green – Parsons Transportation Group Inc.

FROM: George Urch – Frank Wilson & Associates
Kelly Poffenberger – Frank Wilson & Associates

DATE: March 24, 2000

SUBJ: KEY FINDINGS FROM RECENT MARICOPA COUNTY, ARIZONA SURVEY

Enclosed please find a few of our thoughts regarding key findings from the recent telephone poll conducted by Lawrence Research between December 7 and 14, 1999 of 500 adult licensed drivers in Maricopa County, Arizona regarding their thoughts and opinions on various local transportation issues, including HOV lanes, HOT lanes, and value pricing.

I. TRANSPORTATION AS AN ISSUE IN MARICOPA COUNTY

Transportation Is A Perceived Problem in Maricopa County

1.) A very high percentage of Maricopa County residents perceive transportation as an important problem in the Valley.
- On a scale of 1 to 10, with 10 meaning transportation is a very important problem in the Valley and zero meaning it is unimportant, 69% of the respondents ranked transportation between 8 and 10.
- Only 5% of the respondents ranked transportation between 0 and 3.

People who are more likely to feel transportation is an important problem facing the Valley are:
a.) 62% of residents who have lived in Maricopa County for over 30 years
b.) 62% of those who have post-graduate degrees
c.) 62% of those with a yearly income between $75,000 - $100,000
d.) 60% of those between the ages of 55-64
e.) 57% of women
f.) 59% of those whose daily commute is less than 15 minutes

People who are more likely to feel transportation is not an important problem facing the Valley are:
a.) 18% of those who disapprove of HOV lanes
b.) 15% of those with yearly income between $25,000 - $35,000
c.) 12% of those who have lived in Maricopa County between 5 –10 years

II. VALLEY FREEWAY USAGE AND COMMUTING BEHAVIOR

A Large Part Of The Community Do Not Use The Valley Freeways To Commute

1.) Forty percent of those surveyed either do not use the Valley freeways, or use them sparingly to commute to work, school, or other such trips.

People who are more likely to use the Valley freeways on a regular basis (more than 80% of the time) are:

a.) 59% of those have a commute time longer than 45 minutes
b.) 39% of those who disapprove HOV lanes (This could be an indication that frequent users of the freeway are solo drivers, thus want to see the carpool lanes open for regular use during rush hour traffic. 77% of those who disapprove of HOV lanes feel the carpool lanes are not adequately used during the rush hour)
c.) 35% of those who have an income level between $50,000 - $75,000
d.) 34% of those between the ages of 21-34
e.) 34% of those who have lived in Maricopa County between 10-20 years

People who are more likely not to use the Valley freeways on a regular basis (use less than 20% of the time) are:

a.) 56% of those aged 65 and over
b.) 48% of those with yearly income less than $25,000
c.) 49% of women
d.) 50% of those who have lived in Maricopa County for 5-10 years

A Large Part Of The Community Has A Short Commute Time Or Does Not Commute At All

2.) One-third of the respondents indicated they do not commute.

- 23% said daily commute is between 15 – 29 minutes

People who are more likely not to commute include:

a.) 80% of those aged 65 and over
b.) 48% of those with a yearly income less than $25,000
c.) 43% of those who have a high school degree or less

People who more likely to commute between 15 – 29 minutes include:

a.) 34% of those who have a yearly income between $75,000 –$100,000
b.) 30% of those between the ages of 21-34
c.) 30% of those between the ages of 45-54
d.) 27% of those who have lived in Maricopa County for less than 3 years
e.) 27% of those who voted in the general election only

A Small Percentage of Residents Commute Longer Than 45 Minutes Daily

1.) Only 9% surveyed have a daily commute time longer than 45 minutes.

People more likely to have a daily commute longer than 45 minutes are:

a.) 13% of those who have a yearly income level between $50,000 -$75,000 b.) 10% of those who have lived in Maricopa County between 3-5 years

c.) 8% of men

III. HOV LANES

A Large Part Of The Community Are Aware Of And Have Used The Carpool Lanes In Maricopa County

1.) A very high percentage of Maricopa County residents have heard of carpool lanes and have used them in the Valley.

- 79% said they have heard of carpool lanes and have used them in the Valley.

People who are more likely to have heard of carpool lanes and have used them in the Valley are:
a.) 95% of those who have a yearly income level over $100,000
b.) 91% of those who have a daily commute over 45 minutes
c.) 90% of those who have post-graduate degrees

People who are more likely to have not heard of carpool lanes and not use them in the Valley are:
a.) 17% of those who have a yearly income under $25,000
b.) 6% of those who do not vote
c.) 8% of those who have a high school diploma or less

Maricopa County Residents Overwhelmingly Approve Of The HOV Lane Concept

1.) A very high percentage of Maricopa County residents favor the HOV lane concept.

- 86 % approve of HOV lanes
- 62% *strongly* approve of HOV lanes

People who are more likely to approve of HOV lanes are:
a.) 92% of those who have a yearly income between $75,000 -$100,000
b.) 88% of those who have a post-graduate degree
c.) 96% of those who have a daily commute less than 15 minutes
d.) 93% of those who have a daily commute between 30-44 minutes
e.) 93% of those who approve HOT lanes
f.) 89% of women
g.) 91% of those who have lived in Maricopa County between 3-5 years

People who are less likely to approve of HOV lanes are:
a.) 17% of those who disapprove HOT lanes
b.) 18% of those who disapprove of value pricing
c.) 14% of men
d.) 15% of those who have lived in Maricopa County for over 30 years
e.) 24% of those between the ages of 55-64

Although Very Supportive Of The HOV Lane Concept, Most Maricopa County Residents Do Not Use Them

1.) Two-thirds of those surveyed use the carpool lanes on the Valley freeways either sparingly or not at all (less than 20% of the time and never).

- 66% either use the carpool lanes in the Valley sparingly or not at all

People who are more likely to use the HOV lanes in the Valley on a regular basis (80% or more of the time) are:
a.) 12% of those who have lived in Maricopa County for 3-5 years
b.) 11% of those who have a daily commute between 30-45 minutes
c.) 9% of those who have a yearly income level between $50,000 - $75,000
d.) 9% of those who are college graduates
e.) 9% of those who approve of HOT lanes

People who are more likely to use the HOV lanes in the Valley sparingly (less than 20%) or not at all are:
a.) 75% of those who have a yearly income of less than $25,000
b.) 67% of those who do not commute
c.) 73% of those who have a high school diploma or less

Most Residents Agree That Additional HOV Lanes Should Be Constructed

1.) Nearly three-fourths of Maricopa County residents agreed that more HOV lanes should be built in the Valley.

- Nearly 75% agreed that more HOV lanes should be built on Valley freeways

People who are more likely to agree that additional HOV lanes should be built on Valley freeways are:
a.) 82% of those who approve of dynamic value pricing
b.) 80% of those who approve of HOT lanes
c.) 79% of those who have lived in Maricopa County for 3-5 years
d.) 85% of those who have a daily commute time of less than 15 minutes (altruistic)
e.) 87% of those who voted in the general election only

People who are more are likely to agree that no additional HOV lanes should be built on Valley freeways are:
a.) 28% of those who disapprove of dynamic value pricing
b.) 24% of those who are aged 65 and over
c.) 27% of those who have a yearly income between $50,000 - $75,000
d.) 27% of those who have a yearly income between $25,000 - $35,000

IV. HOT LANES

Maricopa County Residents Are Split On the Concept of HOT Lanes

1.) Upon the initial explanation of the HOT lanes concept, nearly 40% of Maricopa County residents approved, while 47% disapproved. They aren't as sure about the HOT Lanes concept as they are about the HOV lanes concept.

People who are more likely to approve the HOT lanes concept are:
a.) 58% of those who approve of the dynamic value pricing concept
b.) 53% of those who have a yearly income over $100,000

c.) 505 of those who have a post-graduate degree
d.) 51% of those who have a daily commute time of less than 15 minutes
e.) 50% of those between the ages of 45-54

People who are less likely to approve the HOT lanes concept are:
a.) 71% of those who disapprove of the dynamic value lane pricing concept
b.) 71% of those who disapprove of HOV lanes
c.) 62% of those who have a yearly income between $25,000 - $35,000
d.) 55% of those who have a high school diploma or less
e.) 53% of men
f.) 53% of those aged 65 and over

Half Of The Residents Favor Basing The Price Of Using The HOT Lanes On The Amount Of Traffic On The Regular Freeway Lanes And Favor Operating The HOT Lanes 24 Hours A Day

1.) Half of the respondents agree that the price should be based upon the traffic flow.

People who are most likely to agree are:
a.) 70% of those who approve of dynamic value pricing
b.) 60% of those who have a yearly income over $100,000
c.) 58% of those who have a post-graduate degree
d.) 58% of those between the ages of 45-54

People who are most likely not to agree are:
a.) 59% of those who have a yearly income of less than $25,000
b.) 64% of those who disapprove dynamic value pricing
c.) 56% of those who disapprove HOT lanes
d.) 68% of those who disapprove HOV lanes
e.) 55% of those who have a daily commute of 45 minutes or longer

2.) Half of the respondents agree to operate the HOT lanes 24hours a day

People who are more likely to agree include:
a.) 65% of those who approve HOT lanes
b.) 62% of those who approve of dynamic value pricing
c.) 59% of those between the ages of 21-34
d.) 56% of those who have post-graduate degree
e.) 56% of those who have a yearly income between $75,000 - $100,000
f.) 55% of those who have a daily commute of 45 minutes or more

People who are less likely to agree include:
a.) 59% of those who disapprove of HOT lanes
b.) 67% of those who disapprove of HOV lanes
c.) 59% of those who disapprove of dynamic value pricing
d.) 51% of those who have a daily commute time of less than 15 minutes
e.) 49% of those who have a daily commute time between 15-29 minutes

Residents Lean Against The Idea of Having A Government Agency Build And Operate The HOT Lanes. They Are Even Less Excited About Having A Private Company Build And Operate Them.

1.) 51% of the respondents disapprove of having a government agency build and operate the HOT lanes.

People who are more likely to agree include:
a.) 57% of those who approve of HOT lanes
b.) 55% of those who approve of dynamic value pricing
c.) 50% of those who have a post-graduate degree
d.) 49% of those who have a yearly income of more than $100,000
e.) 51% of those who have a daily commute of less than 15 minutes
f.) 48% of those between the ages of 21-34

People who are more likely to disagree include:
a.) 75% of those who disapprove of HOV lanes
b.) 65% of those who disapprove of HOT lanes
c.) 58% of those who have lived in Maricopa County between 3-5 years
d.) 57% of those who have a daily commute time of 45 minutes and longer
e.) 55% of those who have a yearly income between $35,000 - $50,000

2.) 60% of respondents disagree that a private company should build and operate HOT lanes.

People who are more likely to agree include:
a.) 46% of those who approve of HOT lanes
b.) 47% of those who approve of dynamic value pricing
c.) 38% of those who have a post-graduate degree
d.) 36% of those who have a yearly income between $75,000 - $100,000
e.) 40% of those who between the ages of 45-54

People who are more likely not to agree include:
a.) 79% of those who disapprove of HOV lanes
b.) 77% of those who disapprove of dynamic value pricing
c.) 77% of those who disapprove of HOT lanes
d.) 68%who have a daily commute of 45 minutes or longer
e.) 645 of those aged 65 and older

The Concept of Constructing The HOT Lanes As Express Lanes Was Very Popular (Probably Because People Responded Positively to the “Express Lanes” Verbage)

1.) By margin of 60% to 33%, respondents agreed that the HOT lanes should be made into express lanes.

People who were more likely to agree include:
a.) 80% of those who approve of HOT lanes
b.) 76% of those who approve dynamic value pricing
c.) 68% of those who have a yearly income between $75,000 - $100,000
d.) 68% of those who have a post-graduate degree
e.) 72% of those who have a daily commute between 30 – 44 minutes

People who are more likely to disagree include:
a.) 38% of those who have a daily commute time of less than 15 minutes
b.) 49% of those who disapprove of HOT lanes
c.) 67% of those who disapprove of HOV lanes
d.) 49% of those who disapprove of dynamic value pricing

Almost 20% Of The Public Say They Would Use The HOT Lanes Almost Every Day To Save 15 Minutes On Their 45 Minute Commute, If The Cost To Them Is $1

1.) At the cost of $1, 19% said they would use it 80% of time or more.

People who more likely to use sparingly (less than 20% of the time) or never include:
a.) 70% of those who not commute
b.) 66% of those with a high school diploma or less
c.) 73% of those who are older than age 65
d.) 63% of those who have lived in Maricopa County for more than 30 years
e.) 71% of those who earn between $25,000 - $35,000 a year

People who are more likely to use regularly (80% or more of the time)
a.) 33% of those who earn more than $100,000 a year
b.) 30% of those who have a post-graduate degree
c.) 27% of those who have a daily commute of 45 minutes or more
d.) 28% off those who approve of dynamic value pricing

2.) Of those who would use the HOT lanes 20% of the time or more at a cost of $1, 18% said they would use the lanes 80% of time or more for a cost of $2.

Those in this group who are more likely to use the lanes sparingly (less than 20% of the time) or never at a cost of $2 include:
a.) 56% of those who have a daily commute less than 15 minutes
b.) 60% of those who have an income level between $25,000 - $35,000
c.) 48 of those who disapprove of HOT lanes
d.) 48%of those who are non-voters

People more likely to use the lanes regularly (80% or more of the time)
a.) 32% of those who have an income level of over $100,000
b.) 24% of men
c.) 24% of those between the ages of 21-34
d.) 21% of those who voted in the general and primary elections

3.) Of those who would use the HOT lanes 20% of time or more at a cost of $2, 16% said they would use the lanes 80% or more of the time at a cost of $3.

Those in this group who are more likely to use the lanes sparingly (less than 20% of the time) or not at all include:
a.) 52% of those who disapprove of HOV lanes
b.) 50% of those who have an income level of less than $25,000
c.) 68% have a high school diploma or less
d.) 66% of those age 65 and over

People who more likely to use the lanes regularly (80% or more of the time)
a.) 36% of those who have an income of over $100,000
b.) 29% of those who have post-graduate degree
c.) 23% of Men
d.) 20% of those who do not commute
e.) 19% of those who have a daily commute between 15-29 minutes
f.) 19% of those who have a daily commute of less than 15 minutes

4.) The chart listed below represents the willingness of each commute group of paying to use the HOT lanes to save 15 minutes off of a 45 minute commute, based upon the 500 poll respondents.

$1 HOT Lane Fee	**$2 HOT Lane Fee**	**$3 HOT Lane Fee**
Never/ Less than 20% 55% 20% - 50% 12% 50% - 80% 11.6% 80% or more 19.2%	Never/ Less than 20% 73.6% 20% - 50% 8.4% 50% - 80% 6.6% 80% or more 7.8%	Never/ Less than 20% 84.2% 20% - 50% 5.2% 50% - 80% 3.2% 80% or more 3.6%

<u>The Use Of Toll Revenue From The HOT Lanes To Expand The Freeway System In Maricopa County Is An Extremely Popular Concept</u>

1.) 80% of Maricopa County residents approve the use of toll revenue for freeway expansion

People who are more likely to approve the use of toll revenue for freeway expansion are:
a.) 98% of those who have a yearly income over $100,000
b.) 90% of those who approve HOT lanes
c.) 91% of those who approve of dynamic value pricing
d.) 89% of those who have a daily commute of over 45 minutes
e.) 88% of those between the ages of ages 21-34

People who are less likely to approve the use of toll revenue for freeway expansion are:
a.) 37% of those who disapprove of HOV lanes
b.) 31% of those who disapprove of dynamic value pricing
c.) 29% of those between the ages of 55-64
d.) 29% of those who disapprove of HOT lanes
e.) 28% of those who have a yearly income of less than $25,000

<u>A Large Part Of The Community Favors The Use Of Toll Revenue To Make Local Street Improvements In Maricopa County</u>

2.) 77% of Maricopa County residents approve the use of toll revenue for local street improvements.

People more likely to approve the use of toll revenue for local street improvements are:

a.) 93% of those who have a yearly income of over $100,000
b.) 87% of those who approve of HOT lanes
c.) 86% of those between the ages of 21-34
d.) 88% of those who approve of dynamic value pricing

People less likely to approve the use of toll revenue for local street improvements are:
a.) 31% of those who have a yearly income level between $35,000 - $50,000
b.) 27% of those between the ages of 55 - 64
c.) 29% of those who disapprove of HOT lanes
d.) 33% of those who disapprove of HOV lanes

A Large Part Of The Community Favors The Use Of Toll Revenue To Expand Existing Transit Services In Maricopa County

3.) 79% of Maricopa County residents approve the use of toll revenue to expand existing transit services.

People more likely to approve the use of toll revenue to expand existing transit services are:
a.) 92% of those who have post-graduate degree
b.) 90% of those who approve of dynamic value pricing
c.) 87% of those between the ages of 21 – 34
d.) 88% of those who have a daily commute of 15 minutes or less

People less likely to approve the use of toll revenue to expand existing transit services are:
a.) 39% of those who disapprove of HOV lanes
b.) 38% of those who have a yearly income of less than $25,000
c.) 24% of those who are age 65 and older
d.) 24% of those who disapprove of HOT lanes

Nearly Three-Fourths Of The Community Approve The Use Of Revenue From The HOT Lanes To Promote Air Quality Improvements By Reducing Vehicle Emissions And Promoting Telecommuting

4.) 74% of Maricopa County residents approve the use of toll revenue to promote air quality improvements by reducing vehicle emissions and promoting telecommuting.

People more likely to approve the use of toll revenue to promote air quality improvements by reducing vehicle emissions and promoting telecommuting are:
a.) 84% of those who have an annual income level of over $100,000
b.) 88% of those who have a post-graduate degree
c.) 85% of those who have lived IN Maricopa County between 3-5 years
d.) 87% of those who are between the ages of 2121-34
e.) 80% of women

People less likely to approve the use of toll revenue to promote air quality improvements by reducing vehicle emissions and promoting telecommuting are:
a.) 30% of those who have lived in Maricopa County for over 30 years
b.) 27% of those who have income level between $50,000 - $75,000
c.) 26% of men

Half Of The Residents Favor The "Dynamic Value Lane Pricing" Concept.

People more likely to approve of the dynamic value pricing concept are:
a.) 75% of those who have a yearly income of $100,000 or more
b.) 72% of those who approve of HOT lanes
c.) 61% of those between the ages of 21 - 34
d.) 65% of those who have lived in Maricopa County less than 3 years

People more likely to disapprove of the dynamic value pricing concept are:
a.) 70% disapprove of HOV lanes
b.) 62% have a yearly income of less than $25,000
c.) 53% of those who have a high school diploma or less
d.) 51% of those age 65 and over
e.) 52% of those who have lived in Maricopa County for over 30 years

VI. ATTITUDES TOWARD HOV AND HOT LANES

Over Half Of The Residents Favor Building More HOV and HOT Lanes

1.) 57% residents said even if they do not use HOV and HOT lanes, others will and that will ease congestion on the general-use lanes.

People more likely to approve building more HOV and HOT lanes are:
a.) 76% of those who have a yearly income of $100,000 or more
b.) 73% of those who have a daily commute of more than 45 minutes
c.) 66% of those who have lived in Maricopa County between 10 – 20 years
d.) 59% of women

People less likely to approve building more HOV and HOT lanes, indicating it's unfair to use taxpayers money to build them and then to charge people to use them are:
a.) 52% of those who have a yearly income between $25,000 - $35,000
b.) 48% of those who have a high school diploma or less
c.) 41% of those who are age 65 and over
d.) 43% of those who have lived in Maricopa County 30 years or longer
e.) 41% of Men

VII. VOTING BEHAVIOR

A Very High Percentage Of Voters Approve Of The HOV Lanes Concept

- 84% of residents who voted in both elections approve of the HOV lanes concept.
- 92% of residents who voted in the General election only approve of the HOV lanes concept.
- 88% of non-voters approve of the HOV lanes concept.

Over One-Third Of Voters Approve Of The HOT Lanes Concept

- 36% of residents who voted in both elections approve of HOT lanes concept.
- 35% of residents who voted in the General election only approve of HOT lanes concept.
- 46% of non-voters approve of HOT lanes concept.

Nearly One-Third Voters Agree That A Private Company Should Build And Operate The HOT Lanes

- 33% of residents who voted in both elections agree that a private company should build and operate the HOT lanes.
- 33% of residents who voted in the General election only agree that a private company should build and operate the HOT lanes.
- 32% of non-voters agree that a private company should build and operate the HOT lanes.

VIII. SUMMARY OF OPEN-ENDED QUESTIONS RESPONSES

Transportation-related problems

- Nearly 61% of those surveyed indicated that congestion/traffic and an inadequate freeway system were the most important transportation-related problem facing the Valley.

Approve of HOV lanes

- 54% indicated they approved of HOV lanes because the lanes help move traffic and decreases traffic congestion.

Disapprove HOV lanes

- Nearly 6% indicated they disapprove of HOV lanes because the lanes are not used.

Approve HOT lanes

- 11% indicated they approved of HOT lanes because the lanes assist in moving traffic.

Disapprove of HOT lanes

- Nearly 15% indicated they disapproved of HOT lanes because the user is charged a fee.

APPENDIX B

Focus Group #1 Summary

ADOT/MAG
VALUE LANE STUDY

FOCUS GROUP #1
SUMMARY

From

July 7, 1999 Focus Group

Prepared for:
Arizona Department of Transportation
And
Maricopa Association of Governments

August 1999

Introduction

The Public Involvement Plan for the ADOT/MAG Value Lane Study includes conducting two focus groups. Input obtained from the focus groups will be used to inform ADOT and MAG project staff of the attitudes and values of potential customers and identify the consumers' needs, concerns, wants, and expectations. Input obtained from the groups will provide the background for policies, programs, services, and the allocation of resources to be developed in the Value Lane Study.

The first focus group was conducted on July 7, 1999. Focus group members were selected by a local market research firm. The one condition that was common to all members of the group was that they use the existing freeway system in the Phoenix metropolitan area. A total of 12 people participated in the focus group (6 male/6 female). Most lived and worked in Phoenix. A few lived just outside the city including Glendale and Mesa. Occupations included: computer engineer, school teacher, retired, insurance sales, and housewife. The ages ranged from 29 to 66.

The focus group was facilitated by Stephen Beard, President of S.R. Beard and Associates. Other agency and consultant staff observing the group were:

John Farry, S.R. Beard & Associates
Bill Hayden, ADOT
Larry Langer, Parsons Transportation Group
Kelly Poffenberger, Frank Wilson & Associates

A focus group discussion guide was developed as a script for conducting the focus group (Attachment A). The script was developed to fill two hours of focus group discussion. Included in the guide was an opportunity to complete a questionnaire related to perceptions of the group of congestion on the freeways (Attachment B).

Focus Group Summary

After introductions of the facilitator and focus group members and the establishment of ground rules for the focus group, the facilitator began the process to receive input from the group regarding the issue of value lanes. Following is a summary of the input received following the question asked of the group.

1.) The biggest problem facing the Valley today is ___________.

- Communication
- Freeways
- Lack of infrastructure to support the growth.
- Planning for population growth.
- Completion of highway and public transportation systems.
- Congestion
- Air Pollution
- Economy

- Crime
- Water

2.) The biggest transportation problem in the Valley today is _________.

- Construction
- Not enough carpools.
- Too few freeways.
- Incomplete highway system.
- Takes too long to go across town – no options.
- No cost effective/adequate public transportation.
- Everybody is traveling in different places instead of one central place.
- Lack of lanes on freeways; everybody gets bogged down – lack of capacity.
- More freeways needed.
- Lack of efficient mass transit; don't run on weekends or late enough.

3.) Pick a picture of an animal that describes driving on the Valley Freeways

- Pig – I have four small children. Had to put them in a different school because of the travel time to the school.
- Giraffe – Pretty quick, but not smooth.
- "Fast animal" – Quicker than San Francisco or Los Angeles.
- Cheetah – Better today. Grew up in LA and it's better here (in Arizona).
- "Quick animal" – I-17 is bad but Squaw Peak is good.
- Alligator – Slow but steady. You can move quick sometimes.
- Turtle – Slow.
- Tiger – Aggressive. Freeway not as safe as arterial roads.
- Snail – Had a lot of accidents. Slow traffic.
- Turtle – Live by I-17 – congested.
- Turtle – Determination to get there, slowly but surely. Traffic is bad all afternoon.
- Elephant – Want to be in something big to protect kids.

4a.) Is the freeway traffic on the freeways you travel better or worse than 3 years ago?

- Worse. Continuous construction delays.
- Improvements to overpasses on I-17 are positive.
- We build for today instead of the future.
- Need to bring in the police to better handle accidents. Don't need to block roads.
- Improvements cannot match the growth

4b.) What about congestion in the off-peak periods?

- Congested in the middle of the day.
- Rush hour lasts longer than it used to.
- Going to ball games – it is more congested.

5.) Questionnaire (Following are the questions included in the questionnaire and the responses in parentheses. Where numbers do not add up to total – no responses were given.)

1. How important is it to you to avoid congestion?
   Very Important **(8)**   Important **(4)**   If its convenient   Not important

2. Have you changed the times when you would normally travel in order to avoid congestion?
   Yes **(10)**   No **(2)**
   If so, how often?
   Daily **(9)**   Once a week   Once a month   Other **(1)**

3. Have you ever changed the way you travel to avoid congestion or help to reduce congestion?   Yes **(8)**   No **(4)**
   If yes, do you?:   Take the bus   Carpool **(3)**   Telecommute   Other **(4)**
   Do you alter your choice regularly?   Daily **(2)**   Once a week **(2)**   Once a month **(3)**

4. If you carpool, do you use the High Occupancy Vehicle (HOV) lanes where they currently exist or do you carpool on general purpose lanes with other traffic?
   Use HOV lanes **(4)**   Use general purpose lanes **(2)**

5. Are HOV lanes a sufficient incentive to carpool during rush hour?   Yes **(7)**   No **(4)**

6. If you commute to work, does it take longer to make that commute than it did 3 years ago?
   Yes **(6)** No **(4)**

7. Are you concerned that traffic on the Valley freeways will get worse?   Yes **(11)**
   No **(1)**

8. If you were the transportation czar, how would you try to improve congestion on the freeways?
   - More lanes and more freeways.
   - Speed up completion of currently planned freeways and add capacity to those currently in place.
   - Quicken pace of freeway completion and broaden scale – more lanes – but first I would need the $ to do this.
   - Give carpool tax incentives.
   - Eliminate HOV lanes and open for use by all.
   - Increase number of lanes. Use HOV lanes for regular traffic.
   - Build more freeways with more lanes.
   - With carpooling and better freeways.
   - Finish the construction that ties the portions of the freeways together.
   - Carpool sign-ups (free ads in newspaper) – include parking areas with security.
   - Add freeways, stagger work hours, increase bus (mass transit) frequency and amount.

- Train police agencies as to better ways of not blocking roads when there is an emergency. Hire concrete specialists for more lasting highways (good formula).

6.) Has anyone heard of congestion pricing?

- Immediate response – 1 person had heard of it, but generally, no.
- No one could pay for it

7.) *(At this point a 13-minute video is shown entitled* ***"Buying Time: A new strategy for traffic congestion relief".*** *The video was produced by the Federal Highway Administration and Minnesota DOT.*

Please list positives and negatives of value pricing (after seeing the video).

Positives:

- Optional
- Raises revenue
- Travel time savings
- Less accidents
- Less congestion
- Reduce pollution
- Can pay for convenience
- More quality time with family

Negatives:

- Some won't be able to afford it
- Causes class division
- Can't trust government to take care of revenues
- Installation expense
- More administrative costs
- What about during emergencies? Will accidents create more traffic thus increasing the cost of the toll?
- More administrative costs
- Enforcement
- Only one lane?
- San Diego I-15 – what good is 8 miles?
- Phoenix is not at capacity yet
- Depends on the cost
- Getting enough people to sign up
- Big brother – privacy concerns on information from transponders
- Black market for transponders
- Theft of transponders

(During the video, one participant shook her head in agreement during the explanation of the I-15 Express Lanes. Also, another participant (housewife with four children) shook her head in agreement when a SR-91 Express Lanes customer told of how he had to pay extra money for daycare because he was late picking up his daughter because of traffic)

8.) What should be done with the revenues raised?

- Put revenue into the roads.
- Needs to be voted on by the people.
- Hard sell in Arizona.

9.) How much would you be willing to pay?

- Depends if the end result is important.
- Value of time.
- Would pay more if you got there faster.
- Just get a transit system that moves fast.

10.) Valley considerations to Value Pricing

- A big hurdle.
- Would work better in more higher density area.
- Maybe five years down the road we will realize it was a good thing.
- Why not open up all the lanes?
- In certain areas it would make sense.

11.) Five years from now, do you think we will have Value Pricing?

- No, not that bad yet.
- Real advantage is you have choice.
- Has some merit.
- Give it a shot.
- One participant mentioned the fact that "changing things" plays a role. He said that if we had HOT lanes now, in five years, commuters would think the lanes are simply part of the transportation system. It's just that first step in changing something that people become hesitant.

APPENDIX C

Focus Group #2 Summary

ADOT/MAG
VALUE LANE STUDY

FOCUS GROUP #2
SUMMARY

From

April 5, 2000 Focus Group

Prepared for:
Arizona Department of Transportation
And
Maricopa Association of Governments

April 2000

Introduction

The Public Involvement Plan for the ADOT/MAG Value Lane Study includes conducting two focus groups. Input obtained from the focus groups will be used to inform ADOT and MAG project staff of the attitudes and values of potential customers and identify the consumers' needs, concerns, wants, and expectations. Input obtained from the groups will provide the background for policies, programs, services, and the allocation of resources to be developed in the Value Lane Study.

The first focus group was conducted on July 7, 1999. A summary of results of that focus group was presented to ADOT and MAG in August of 1999. Subsequent to the first focus group, a public opinion survey was completed to gather opinions on High Occupancy Vehicle (HOV) use and the Value Lane concept. The second focus group was designed to test and confirm results of the public opinion survey related to High Occupancy Vehicle (HOV) lanes and Value Lanes.

The second focus group was conducted on April 5, 2000. Participants were selected by a local market research firm. The one condition that was common to all members of the group was that they use the existing freeway system in the Phoenix metropolitan area at least 20 minutes per day. A total of 12 people participated in the focus group (8 male/4 female). Eight participants lived in east valley cities, three from west valley cities, and one participant lived in Phoenix. Seven participants were employed full time. The ages ranged from 33 to 71.

The focus group was facilitated by John Farry of S.R. Beard and Associates. Other agency and consultant staff observing the group were:

Bill Hayden, ADOT
Mark Schlappi, MAG

A focus group discussion guide was developed as a script for conducting the focus group (Attachment One). The script was developed to fill two hours of focus group discussion. Included in the guide was an opportunity to complete a survey and a questionnaire (Attachment Two) related to perceptions on HOV lanes and Value Lanes.

Focus Group Summary

After introductions of the facilitator and focus group members and the establishment of ground rules for the focus group, the facilitator began the process to receive input from the group regarding the issue of value lanes. Some highlights of the focus group included:

- When asked about the most challenging issue facing this area, one-half of the respondents responded with transportation. The issues of population growth and education were also sited.

- The public opinion poll conducted between the two focus groups found a high level of popularity for HOV lanes. The second focus group recruited people who used the freeways at least 20 minutes per day to determine their attitudes on HOV lanes. The second focus group confirmed the popularity of HOV lanes. When asked to respond to the statement, "HOV lanes are wasted space and should be opened up to everyone." -- 11 of 12 participants disagreed with the statement. When asked to respond to the statement, "If HOV lanes were opened to everyone, they would fill up and congestion would be the same or worse than it is today." -- 10 of 12 participants agreed.

- In general, Express Lanes had limited support. However, after viewing a video produced by the Federal Highway Administration, some attitudes about Express Lanes became more positive.

Focus Group Responses

Following are specific responses received from focus group participants. The moderator comments are printed in italics for purposes of reference.

I. Participant Introductions

Moderator: *Please go around the table for introductions. Tell us:*

i) The city and major cross streets where you live;
ii) Where you work (location);
iii) Type of work you do;
iv) Which freeway do you regularly use;
v) Whether or not you pay for parking;
vi) *What do you consider to be the most important issue facing the valley (i.e. crime, education, transportation, air pollution)?*

Participant #1
i. Chandler, AZ Ave./Pecos
ii. Retired
iii. Prep cook - Red Lobster
iv. 101/202 – takes wife to work
v. No parking fees
vi. Growth of the Valley

Participant #2
i) Glendale, 43rd Avenue / Bethany Home Road
ii) Unemployed/retired
iii) Was a state employee, executive secretary
iv) Used I-17 & 51, Now uses 101 (quicker)
v) No parking fees
vi) Transportation

Participant #3
i) Tempe, Baseline and Rural/Lakeshore
ii) Works in Scottsdale
iii) Sales rep.

iv) Superstition / I-10 / I-17
v) No parking fees
vi) Transportation -- been in Arizona for 15 years. Stated Arizona is nationally rated #2 regarding road conditions.

Participant #4
i) Gilbert, Baseline / Guadalupe off of Higley
ii) 48th Street / Baseline
iii) Admissions Advisor at a University
iv) Baseline or 60
v) No parking fees
vi) Transportation -- six-year resident, lives in Gilbert due to less traffic

Participant #5
i) Tempe, Broadway / Price
ii) 20th Street / Washington
iii) Paralegal
iv) 101 / 202 every day, I-17 / I-10 weekends
v) No parking fees
vi) Uncontrolled growth

Participant #6
i) Chandler, Alma School / Elliot
ii) N/R
iii) Semi-retired
iv) 60 / 101 / 202
v) No parking fees
vi) Crime

Participant #7
i) Scottsdale, 56th Street / Bell
ii) 27th Avenue / Beardsley
iii) Computer Analyst
iv) 101 / 51
v) No parking fees
vi) Education – teacher pay

Participant #8
i) Scottsdale, Thunderbird / 56th Street
ii) Downtown
iii) Retired – Volunteer for Phoenix Art Museum (2-3 days per week)
iv) 51
v) No parking fees
vi) Education / parking / transportation

Participant #9
i) Phoenix, 59th Avenue / Camelback
ii) Sun City West
iii) Land Surveyor
iv) I-10 / I-17, sometimes 101 / 303
v) No parking fees
vi) Education

Participant #10
i) Glendale, 51st Avenue / Union Hills
ii) 7th Street / Camelback

iii) Outside Sales Rep
iv) Use all freeways (sometimes every day)
v) No parking fees
vi) Growth, control, sprawl

Participant #11
i) Phoenix, 51st Avenue / Bell Road
ii) Goodyear
iii) Retired, after 16 years
iv) I-17 / I-10 / 51 / 60
v) No parking fees, except for ball game parking
vi) Transportation

Participant #12
i) Mesa, University / Mesa Drive
ii) Priest / 101
iii) RE Investor
iv) Uses all freeways, mostly 202
v) No parking fees
vi) Transportation / education (toss up)

II Traveling on Valley Freeways

Moderator: *What is the first thing that comes to your mind when you think about driving on the freeway?*

#1 Easy freeway access.
#2 Story re: 51. Stoppage / New Jersey Turnpike
#3 Avoids freeways. Prefers surface streets. Doesn't like the crowds and the slowing down.
#4 Avoids freeways depending on time of day. Construction closes them down – uses surface streets.
#5 Prays that freeways aren't congested prior to getting on them.
#6 Congestion – stays away from freeways as much as possible. Will not tough 51.
#7 Don't mind freeways, they are backed up, but they are facing in one direction. Wife is scared of freeways, that's why I take her to work.
#8 Likes new 101 because it gets you around town a lot quicker. Avoids I-17, used Grand Avenue instead to get to work downtown. Grand Avenue didn't back up like the freeways did.
#9 Congestion. Prefers freeways except during rush hour.
#10 People getting off freeway at the last minute. Cops shouldn't talk to people on the side of the road. She uses freeways and surface streets interchangeably – whatever works at the time.
#11 Stop and go – uses freeways.
#12 Idiots and lack of courtesy.

Moderator: *Tell me about changes you have experienced on freeway travel over the past 3 years. For instance:*

Has traffic changed during rush hour? Better, worse, or stayed about the same?
Has freeway traffic changed during other parts of the day? Better, worse, or stayed the same?

#1 Express lane for car poolers is a plus.
#2 Worse – it's backed up further.
#3 5 years ago it was a 40 minute drive, now the same drive takes 20 minutes. Even during rush hour, even using the 101. Big improvements in Scottsdale.

#4 Take Shea instead of ??
#5 Freeways increase 100%, Roadway increase 105% - 25 years from now, we'll have the same problem as we do now. It's been improved to a degree, but not that much.
#6 Stayed the same – the improvements can't keep up with the extra traffic.
#7 Getting better, especially in Scottsdale. 60 is ridiculous.
#8 Better since the Squaw Peak extension. 101 is bad only one day a week.
#9 Worse – Chandler population increase, more cars, terrible bus system.
#10 60 is worse, 101 is better.
#11 60 is worse, 101/202 are better.
#12 Better – Time of year has a lot to do with it. Vacationers/visitors.
#13 Travel time has increased due to jobs farther away from home, as opposed to back home.

Moderator: *I have several statements that might apply to you as a user of the freeway system. For each statement, please raise your hand if it applies to you.*

STATEMENTS:

i) *I take a different route to avoid congestion on the freeways.*

Everyone raised hand except for 3 people.

ii.) *I avoid making trips at least once a week due to congestion on the freeway.*

No

iii.) *I have adjusted my schedule to drive at times when the freeways are not so busy.*

Half yes / half no

iv.) *To help reduce congestion, at least once a week I:*

Take the bus; - No answer
Carpool; - No answer
Telecommute. – 2 hands

III. HOV Lanes

Moderator: *Is everyone familiar with the High Occupancy Vehicle (HOV) lanes that exist on some of the freeways? A plan is being developed to expand and connect HOV lanes to make them more convenient. (A graphic of the planned HOV system was distributed.) In general, do you think the plan should be implemented?*

#1 Yes
#2 Yes
#3 Yes
#4 Yes
#5 Yes
#6 Yes, money spend on freeways should be put into transit.
#7 Does not use it enough, but finds it hard to get exit off of the HOV lane. Geared for long distance, it would be a plus.
#8 Hard to exit.
#9 Great idea. Why didn't they put HOV lanes in the Squaw Peak initially? Now they are tearing up the roads to do it.
#10 Good thing, exiting them a problem, bottlenecks traffic.
#11 It should have been done originally.

#12 Yes, easier access needed.
#13 Yes, Can drive faster on them, but hard to cross traffic to exit.

Moderator: *I would now like to distribute a survey about the HOV plan. When completing the survey, assume that HOV has been constructed.*

SURVEY RESULTS

1. Even before the HOV system was expanded, I carpooled at least once a week. I carpooled because ____.

#1 Faster, cuts off 15 minutes of traffic.
#2 Work hours don't allow.
#3 N/A.
#4 To help the traffic congestion and convenience.
#5 No answer.
#6 Made getting where I was going faster.
#7 Someone had no way to get to work.
#8 Don't carpool.
#9 It saves time and expenses.
#10 No answer.
#11 I worked with a person in the office.
#12 My wife likes me to drive and take the freeways.

2. Now that the HOV system has been expanded, there is enough incentive for me to join a carpool.

Agree _4__ Disagree _7__ No Answer ___1_____

3. In order for me to carpool, the HOV lanes need to have more entrance and exit ramps for direct access so I don't have to cross traffic to access them.

Agree _8_ Disagree __4__

4. Freeway congestion has not gotten bad enough for me to consider carpooling in HOV lanes.

Agree _3_ Disagree _8__ No Answer _____1___

5. Even with completion of the expanded HOV system, I need additional incentive to get me to carpool on HOV lanes. For me to carpool *(choose from a, b, and/or c – but choose only one item under a, b, and c)*:

Parking costs per day would have to be increased:
$1.00 _2___
$5.00 _4___
$20.00 _2___
No Answer __3__

The cost of gasoline would have to increase to:
$2.00 per gallon _4___
$3.00 per gallon _4___
$4.00 per gallon _____
No Answer __3__

The reward for carpooling should result in an annual reduction in the cost of registering my automobile by:

$20 __4__
$50 _____
$100 __4__
No Answer __4___

6. HOV lanes are wasted space and should be opened up to everyone.

Agree _1________ Disagree __11_________

7. If HOV lanes were opened to everyone, they would fill up and congestion would be the same or worse than it is today.

Agree _10_______ Disagree __2__________

Moderator: *Before we move on, I would like to get your opinion on HOV Lane Violations.*

Do you notice that there are people driving alone in the HOV lanes during the time when they are dedicated to two or more persons per vehicle?

The whole group agreed that there are HOV lane violations.

The current HOV lane violation is $70. In some parts of the country, HOV violations are $250 to $300. Do you think the fine is appropriate for the violation?

#1 The inconvenience of getting a ticket is enough.
#2 There should be serious violations.
#3 The first occurrence should be low, then the second occurrence should be higher.
#4 Yes, increase the fine.
#5 Increase it the first time, then really increase it the next time.
#6 Increase it, but there are not enough people to know that it is a violation.
#7 First offense light, second offense heavier.
#8 Heavy fine the first time.
#9 Heavy fine the first time.
#10 No fine increase – sliding scale. Hates to see fines go up for anything – just like taxes.

How do you feel about photo enforcement of HOV restrictions?

#1 Yeah, probably.
#2 Suppose it would be all right.
#3 They couldn't put enough film in the camera. No.
#4 Yes/no, don't care.
#5 No. Had a bad experience with son and photo radar. Good idea if they improve the system.
#6 Is it cost effective replacing film for a police officer?
#7 Good idea, but questions cost effectiveness. Also questions technology.
#8 No photo enforcement necessary. A public commercial should be done on TV to make public aware of rules and regulations of the HOV lane.
#9 Yes, insurance to have photo radar.
#10 No. Loaned son his car that was ticketed. He ended up paying ticket even though his son was driving.
#11 Not a big fan of photo radar, except for photo radar for running red lights. Don't think it's cost effective.
#12 Yes, it could have other impacts such as speed with photo radar.

IV Express Lanes

Moderator: *A new concept, referred to as congestion pricing, is being considered around the country to improve the operation of existing freeways. When implemented, a fee is charged on either a lane dedicated to fee payers or on the excess capacity of HOV lanes to vehicles willing to pay a fee. The HOV lanes would continue to exist. For our purposes, I will refer to the congestion-pricing lane as an Express Lane. The fee for using the Express Lane is based on the amount of travel that exists on the freeway as a whole. In other words, the more crowded the freeways, the higher the Express Lane fee. Does anyone have any questions about Express Lanes?*

Comments: Don't like this. Perceive toll roads. Used to have to pay toll roads back east.

Moderator: *A questionnaire will be distributed regarding Express Lanes. Please take a few minutes to answer the questions. (Moderator collects questionnaire when completed.)*

Moderator: *I will now ask you to watch a video which further explains the concept of congestion pricing. (Video is shown).*

Moderator: *The same Express Lane questionnaire will be distributed again. (Moderator collects questionnaire.)*

QUESTIONNAIRE RESPONSE COMPARISON

1. Would you be willing to pay a fee to use Express Lanes to bypass the congestion on the other freeway lanes during rush hour:

	Before video	**After video**
Most of the time	1	2
Only when I need to get somewhere in a hurry	3	5
I would hardly ever use them	8	5

2. If an Express Lane were available during rush hour, and you could save 15 minutes on a 45 minute commute at the cost of $1, would you use the Express Lane:

	Before video	**After video**
Less than 20% of the time	7	6
20% to 50%	0	1
50% to 80%	2	2
80% or more	3	3

3. If the Express Lane cost was $3 and you saved 15 minutes on a 45 minute commute, would you use the Express Lane:

	Before video	**After video**
Less than 20% of the time	4	6
20% to 50%	6	4
50% to 80%	1	2
80% or more	1	0

4. Do you think Express Lanes would work in this area?

Yes, Express Lanes would work because ________________________________.

Before video	After video
Most people here are from out of state and are used to paying for toll roads, so I think it would work.	Most people here are from out of state and are used to paying for tolls. Also, families would be willing to pay extra.
To a degree because there will be always be people that will want to save time whatever the cost.	Traffic would flow easy. Cost will be a big factor here.
Hopefully speed up drive time. Need more info from other places using it.	Yes, it would be an added benefit getting to and from work and home.
	Yes, faster to work and faster home. More quality time.
	Regular traffic would be lessened because of those using the express lane.
	Maybe on US 60
	People would spend to save time.

No, Express Lanes would not work because ______________________________.

Before video	After video
People would not (use) them. How many lanes would the freeway need?	People home a lot are on fixed income – probably would not use them
You would have to have gone nuts to pay to use a road!	There are too many free ways to get to work.
People don't like to pay for something twice. Our gas tax is high already, and the cost of plates.	It opens the way to toll roads and road use should not be restricted.
Somebody would take it to court. Who's money built it?	People are paying taxes for the roads already. I don't think they will want to pay any more.
People are too cheap.	I do not believe we are at the point of congestion in most places where this would be a significant benefit.
I have already paid for the roads and resent being charged again.	Not without some education
People will not pay for roads.	

Moderator: *Did your opinion of Express Lanes change after watching the video?*

#1 Yes, it changed my mind. Good idea after seeing video. I don't have to travel to work every morning, but I think that it would be good for people who do.
#2 Yes, it answered a lot of questions.
#3 Yes. Not too much in favor of toll roads, but can see their worth in certain instances. Don't think I would use them. I can't see paying for road use. We already pay enough taxes. Would rather use surface streets.
#4 Answered questions the same and differently after seeing the video. Would not use toll roads daily. Since he is a volunteer, he would feel offended having to pay. Like the HOV lanes, he is not sure how he would exit the toll road.
#5 Initially would have voted anyone out of office that was in favor of this and thought it was unconstitutional. Now, carpooling people are free. Feels that this is discriminatory i.e.: low-income citizens, which he feels, would create legal issues.
#6 No, used turnpikes back east. Don't think people would pay for this because they're paying taxes already, but then again, we have to pay for the people who draw out these plans also.
#7 No, don't go for this concept. Opens door for ???.

#8 Yes and no. Easy flow of traffic, but cost would be an issue. Depends on cost for me to use. Don't want to pay $15 to use a road.
#9 No it didn't. Stayed the same. Good idea to begin with and still is.
#10 It would open the door for people who couldn't pay i.e.: low income, Sr. citizens.
#11 Negative side. On a fixed income - $40 monthly is too much. We pay enough on gasoline taxes, too much on smog control, on top of your vehicle tags.
#12 Not really, time is money. If it would save me time with a reasonable cost, I would use it. Was positive before and after video.

Moderator: I would now like to get your opinion on the ownership and operation of Express Lanes. Whether you agree or disagree with the concept, please indicate how you would like to see the ownership and operation of Express Lanes structured. The following options are for your consideration:

Private
Public
Joint Public/Private

#1 Private. Don't want any more taxes incurred by the government. If government ran it, I now I would have to pay for it some way or another.
#2 Public. Too many private outfits have gone bankrupt and the government has to pick it up ultimately.
#3 Public. Private industry could go belly-up or sell mid-stream which could cause prices to go up.
#4 Private
#5 Federal or state. Private would start out all right, but wouldn't have the money for repairs or to expand.
#6 Agrees with state or federal ownership.
#7 State or federal. This would make more ways to address the discriminatory issues that would come up.
#8 Same. Prices will go up anyways.
#9 Hopefully not the government because once they get their hands on it, they'll screw it up. Private ownership with the provision that they maintain the operation and cost.
#10 Opposition for private. Would rather give money to the government.
#11 Combination. Private sector will never agree with the government and then the project will never get off the ground. Government will be in control anyways with rules and regulations. Can't see private sector touching it with a 10-foot pole.

Moderator: Finally, I would like to get your opinion on terminology for this concept of congestion pricing. Please pick a name from the following list that is acceptable to you and the reason why you chose it.

Value Lanes
HOT Lanes
Express Lanes

#1 Hot Lanes, not good in Arizona. Express Lanes sounds good.
#2 Value Lanes sounds cheap. Hopefully no one would use it and it wouldn't get built.
#3 Hot Lanes. Catch phrase, got to go with it.
#4 Express Lanes. Most intuitive expression.
#5 Value Lanes sounds best.
#6 Express Lanes is least controversial.
#7 Express Lane with a dollar value to it.
#8 Express Lanes. Same basic reason.
#9 Express Lanes
#10 Hot Express Lanes, but to choose one, it would be Express Lanes.
#11 Express Lanes. Same reason.

#12 Express Lanes. Same reason.

Meeting Adjourned.

ADOT/MAG VALUE LANE STUDY
Focus Group Two Discussion Guide

1) Introduction

   a) Introduction of facilitator

      i) Explanation of focus group research, observers, recording devices, etc.

      ii) Ground rules
         (1) All information is anonymous and confidential.
         (2) Please speak your mind. Seeking candid opinions and ideas.
         (3) Everyone's input is important. To ensure that everyone is heard, only one person encouraged to talk at a time.

   b) Participant Introductions

      i) Would like to hear about the participants. Go around the table for introductions. Please tell us:
         (1) Your name;
         (2) The city and major cross streets where you live;
         (3) Where you work (location);
         (4) The type of work you do;
         (5) Which freeway do you regularly use;
         (6) Whether or not you pay for parking;
         (7) What do you consider to be the most important issue facing the Valley (i.e. crime, education, transportation, air pollution)?

   c) Facilitator's Opening Statement

      The Valley is expected to continue growing at a very rapid rate. Over the next 20 years the population in Maricopa County is projected to increase almost 70 percent. At the same time, travel in the region is expected to increase by 80 percent. *(Bring out display board of population and travel growth.)* While there are plans to increase freeway miles, as well as transit opportunities, congestion on all freeways in the future is expected to increase.

      The Arizona Department of Transportation and the Maricopa Association of Governments are conducting a study of ways to improve travel on the Valley freeway system. *(Bring out display board of Valley freeway system – planned and constructed. Note that the freeway system will be completed in 2007.)* We have been commissioned to seek your input about traveling on the freeway system, as well as potential ways to improve travel conditions on the freeways.

2) Traveling on Valley freeways *(Go around the table and ask for input after each question.)*

   a) What is the first thing that comes to your mind when you think about driving on the freeway?

   b) How much time do you spend on the freeway during the day, and when do you use the freeways -- to commute to work during rush hour or at other times of the day?

   c) Tell me about changes you have experienced on freeway travel over the past 3 years:

      i) Has traffic changed during rush hour? Better, worse, or stayed about the same?
      ii) Has freeway traffic changed during other parts of the day? Better, worse, or stayed about the same?

d) I have several statements that might apply to you as a user of the freeway system. For each statement, please raise your hand if it applies to you.

STATEMENTS:

i) I take a different route to avoid congestion on the freeways.
ii) I avoid making trips at least once a week due to congestion on the freeway.
iii) I have adjusted my schedule to drive at times when the freeways are not so busy.
iv) To help reduce congestion, at least once a week I:
  (1) take the bus;
  (2) carpool;
  (3) telecommute.

3) HOV Lanes

a) Is everyone familiar with the High Occupancy Vehicle (HOV) lanes that exist on some of the freeways? *(If not explain what they are and the restrictions.)* A plan is being developed to expand and connect HOV lanes to make them more convenient. *(Explain the general components of the plan.)* In general, do you think the plan should be implemented?

b) Whether you agree or disagree with this plan, imagine that the HOV system has been completed and that you are responding to a survey at some point in the future. Keeping in mind that the HOV system has been constructed, please take a few minutes to respond to the statements on this handout that are related to HOV lanes. *(Distribute handout.)*

STATEMENTS:

i) Even before the HOV system was expanded, I carpooled at least once a week. I carpooled because ______________________________.
ii) Now that the HOV system has been expanded, there is enough incentive for me to join a carpool.
iii) In order for me to carpool, the HOV lanes need to have more entrance and exit ramps for direct access so I don't have to cross traffic to access them.
iv) The HOV bypass lanes at some of the freeway entrances, if enforced as HOV only, are a good incentive to use HOV lanes.
v) Freeway congestion has not gotten bad enough for me to consider carpooling in HOV lanes.
vi) Even with completion of the expanded HOV system, I need additional incentive to get me to carpool on HOV lanes. For me to carpool *(choose one)*:

  (1) parking costs per day would have to be increased:
    $1.00
    $5.00
    $20.00
  (2) the cost of gasoline would have to increase to:
    $2.00 per gallon
    $3.00 per gallon
    $4.00 per gallon
  (3) the reward for carpooling should result in an annual reduction in the cost of registering my automobile by:
    $20
    $50
    $100
vii) HOV lanes are wasted space and should be opened up to everyone.
viii) If HOV lanes were opened to everyone, they would fill up and congestion would be the same or worse than it is today.

(Collect the handouts and discuss the responses.)

c) Before we move on, I would like to get your opinion on HOV lane violations on the existing HOV lanes. *(Prompt responses from participants.)*

   i) Do you notice that there are people driving alone in the HOV lanes during the time when they are dedicated to two or more persons per vehicle? *(Try to prompt any frustration level with violators.)*
   ii) The current fine for HOV violations is $70. Do you think the fine should be increased?
   iii) In some parts of the country, HOV violations are $250 to $300. Do you think the fine is appropriate for the violation?
   iv) How do you feel about photo enforcement of HOV restrictions?

4) Express Lanes

a) A new concept, referred to as congestion pricing, is being considered around the country to improve the operation of existing freeways. When implemented, a fee is charged on either a lane dedicated to fee payers or on the excess capacity of HOV lanes to vehicles willing to pay a fee. The HOV lanes would continue to exist. For our purposes, I will refer to the congestion pricing lane as an Express Lane. The fee for using the Express Lane is based on the amount of travel that exists on the freeway as a whole. In other words, the more crowded the freeways, the higher the Express Lane fee. Does anyone have any questions about Express Lanes? *(Give brief answers to ensure a general understanding of the concept. Do not explain in detail.)*

   i) Has anyone heard of this concept? *(If anyone begins to discuss toll roads, point out the difference between tolls and congestion pricing.)*

b) Now that you have some understanding of the congestion pricing concept, I will distribute a questionnaire. Take a few minutes to complete the questionnaire.

   QUESTIONS

   i) Would you be willing to pay a fee to use Express Lanes to bypass the congestion on the other freeway lanes during rush hour:
      (1) Most of the time
      (2) Only when I need to get somewhere in a hurry
      (3) I would hardly ever use them
   ii) If an Express Lane were available during rush hour, and you could save 15 minutes on a 45 minute commute at the cost of $1, would you use the Express Lane:
      (1) Less than 20% of the time
      (2) 20% to 50%
      (3) 50% to 80%
      (4) 80% or more
   iii) If the Express Lane cost was $3 and you saved 15 minutes on a 45 minute commute, would you use the Express Lane:
      (1) Less than 20% of the time
      (2) 20% to 50%
      (3) 50% to 80%
      (4) 80% or more
   iv) Do you think Express Lanes would work in this area?

   (Collect the questionnaires)

c) I would now ask that you watch a video, which further explains the concept of congestion pricing. *(Show FHWA video.)*

d) I will now pass out the same questionnaire. Please take a few minutes to respond.

(Collect the questionnaire.)

e) Did your opinion change after watching the video? Why or why not? *(Round table discussion.)*

f) Ownership and Operation -- Several options exist relative to the ownership and operation of Express Lanes. In one of the examples in the video, the Express Lanes are owned and operated by a private company. In others, a government agency owns and operates the facilities. Another option is a joint public/private venture that would own and operate the facility. Which of these options seems most appropriate to you, and why? *(Round table discussion.)*

g) Finally, I would like to get your opinion on the terminology used for the congestion pricing concept. Congestion pricing facilities have been called several different things. Of the following terms, which one do you think is the most appropriate? As I go through the list of terms, please write them down on the paper in front of you, and then indicate which one you think is best by circling it.

i) Express Lanes
ii) HOT Lanes (HOT = High Occupancy Toll)
iii) Value Lanes

h) Why did you choose the term you did?

5) Adjournment

a) Thank you for attending. If you want to stay apprised of the study process, either the MAG or ADOT websites will have information on the study as it progresses.

FOCUS GROUP #2
SURVEY

I. Even before the HOV system was expanded, I carpooled at least once a week. I carpooled because ____.

II. Now that the HOV system has been expanded, there is enough incentive for me to join a carpool.
Agree __________ Disagree _____________

III. In order for me to carpool, the HOV lanes need to have more entrance and exit ramps for direct access so I don't have to cross traffic to access them.
Agree __________ Disagree _____________

IV. Freeway congestion has not gotten bad enough for me to consider carpooling in HOV lanes.
Agree __________ Disagree _____________

V. Even with completion of the expanded HOV system, I need additional incentive to get me to carpool on HOV lanes. For me to carpool *(choose from a, b, and/or c – but choose only one item under a, b, and c)*:

a. parking costs per day would have to be increased:
$1.00 _____
$5.00 _____
$20.00 _____

b. the cost of gasoline would have to increase to:
$2.00 per gallon _____
$3.00 per gallon _____
$4.00 per gallon _____

c. the reward for carpooling should result in an annual reduction in the cost of registering my automobile by:
$20 _____
$50 _____
$100 _____

VI. HOV lanes are wasted space and should be opened up to everyone.
Agree __________ Disagree _____________

VII. If HOV lanes were opened to everyone, they would fill up and congestion would be the same or worse than it is today.
Agree __________ Disagree _____________

FOCUS GROUP #2

QUESTIONNAIRE

6) Would you be willing to pay a fee to use Express Lanes to bypass the congestion on the other freeway lanes during rush hour:

_____ Most of the time
_____ Only when I need to get somewhere in a hurry
_____ I would hardly ever use them

7) If an Express Lane were available during rush hour, and you could save 15 minutes on a 45 minute commute at the cost of $1, would you use the Express Lane:

_____ Less than 20% of the time
_____ 20% to 50%
_____ 50% to 80%
_____ 80% or more

8) If the Express Lane cost was $3 and you saved 15 minutes on a 45 minute commute, would you use the Express Lane:
Less than 20% of the time

_____ 20% to 50%
_____ 50% to 80%
_____ 80% or more

9) Do you think Express Lanes would work in this area?

Yes, Express Lanes would work because ________________________________

____

____.

No, Express Lanes would not work because ______________________________

____

____.

APPENDIX D

Alternative HOV Assessment

APPENDIX D

ALTERNATIVE HOV ASSESSMENT

The baseline cost effectiveness analysis of potential HOV segments (see Section 4 of the Final Report) was performed according to the MAG baseline freeway system plan, which proposes that the portion of Grand Avenue between the Agua Fria Freeway and the Black Canyon Freeway be converted into an expressway. The MAG model, used to determine the projected volumes and speeds that were part of the cost effectiveness analysis, assumes that the aforementioned portion of Grand Avenue has been converted into an expressway by 2020.

In response to questions that arose at a study presentation, ADOT and MAG requested that an alternative HOV cost effectiveness analysis be performed that treats Grand Avenue as a regular city street. In Section 1 of the Final Report, this add-on task is referred to as "Task 10", the HOV alternative assessment. The MAG model was rerun with this alternative freeway network (i.e., no Grand Avenue expressway), and the new data was used to develop a cost effectiveness analysis for the situation "alternative" (e.g., where Grand Avenue was not converted into an expressway). This appendix documents this alternative analysis.

Many of the cost effectiveness rankings remained the same for the potential HOV segments in the alternative HOV analysis, but there were some noticeable differences. The results of this alternative analysis and the differences between it and the baseline cost effectiveness study are discussed in this appendix.

The adopted HOV system plan alternative for this alternative analysis is featured in Figure D-1, which corresponds to Figure 4-1 in the original analysis. The existing and currently planned HOV lanes are the same in both figures; the difference is the coding for Grand Avenue between the Agua Fria Freeway and the Papago Freeway. Figure 4-1 depicts that portion of Grand Avenue as a future (with dashed thick lines) expressway, while Figure D-1 shows it as a regular city street.

The alternative analysis studied mostly the same potential additional HOV segments as the baseline analysis. Some HOV segments were changed in attempt to locate segments that were more cost-effective. For example, the Papago Freeway to Northern Avenue segment of the Agua Fria Freeway featured in the original analysis was extended so that it ran from the Papago Freeway to Grand Avenue. This new segment manages to achieve cost-effectiveness of under $20 per hour (of travel time saved) in the alternative analysis.

The same cost effectiveness measure described in section 4.2 of the Final Report was used to rank the potential HOV segments based upon cost effectiveness data taken from the alternative model runs.

Figure D-1
Alternative Freeway Network and Adopted HOV System Plan Used for Alternative HOV Evaluation

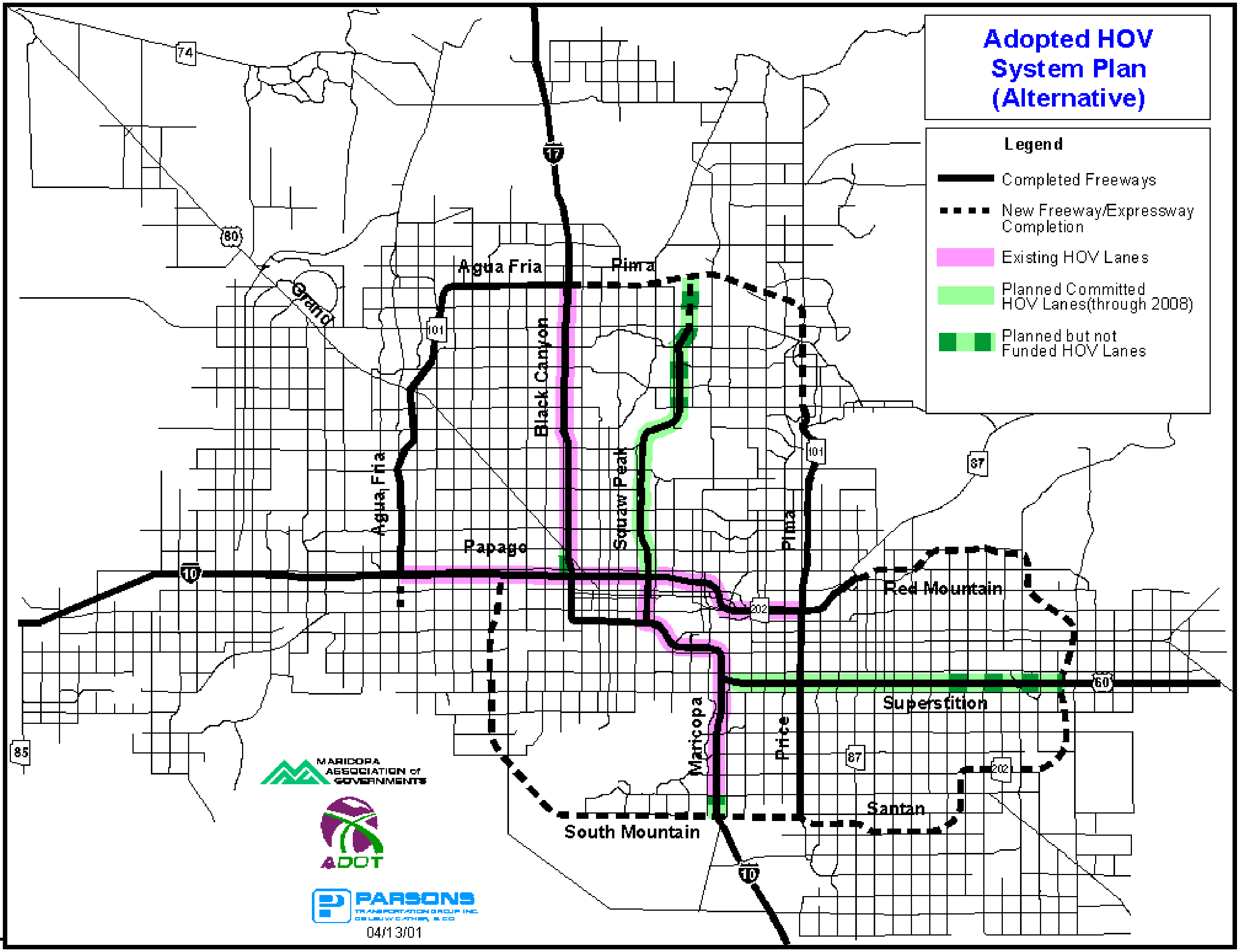


Table D-1 displays the details of the alternative analysis for each potential additional HOV segment. It corresponds to Table 4-1 in the baseline analysis. Thirteen segments received a cost-effectiveness ranking of D or better, compared to only ten segments in the baseline analysis.

The sixteen HOV segments with cost-effectiveness values below $60.00 per hour saved are featured in Table D-2, which summarizes the length and cost-effectiveness of each of these segments. The thirteen segments ranked D or better are separated from the three segments ranked E. Table D-2's analog is Table F-2, in Appendix F, which summarizes segments for the baseline analysis. Both tables also feature currently planned HOV segments, separated into funded and not funded sections.

Segments with higher cost-benefit rankings in the alternative analysis than the baseline analysis include:

- I-10 Papago between 79th Avenue and 3rd Avenue, alternative ranking of A, baseline ranking of B
- I-10 Papago between the Agua Fria River and SR 101 Agua Fria, alternative ranking of C, baseline ranking of D
- SR 101 Agua Fria between Grand Avenue and I-10 Papago, alternative ranking of D, baseline ranking of E.
- SR 101 Agua Fria between I-17 Black Canyon and 67th Avenue, alternative ranking of D, baseline ranking of E.
- SR 101 Price between Chandler Boulevard and SR 202 Santan, alternative ranking of D, baseline ranking of E

Figure D-2 displays the recommended HOV system and cost effectiveness rankings for each HOV segment under the alternative analysis. The color coding of the additional HOV segments varies from that found in the corresponding figure for the original analysis, Figure 4-12, in the same manner as the rankings in Table D-2 versus Table F-2, discussed above.

Table D-1
HOV Alternatives Assessment Details
(Basis for cost-benefit ranking of newly recommended HOV lanes)
[Alternative Evaluation]

Corridor	Segment	Rank	Cost Effectiveness			HOV Volume		Person Trip Throughput		Speed		Time Savings	Segment Length
			Total Cost (millions)	Value $/hr saved	Score	AM Peak	PM Peak	AM Peak	PM Peak	HOV Lane	Regular Lane	(hours per mile)	(miles)
SR-101 - Pima	FL Wright to SR-202	A	$50.61	$1.49	5	1587	1663	3333	3493	53	18	0.038	14.2
I-10	79th Ave to 3rd Ave	A	$64.87	$1.94	5	2367	2358	4970	4952	59	17	0.043	8.4
SR-101 - Price	SR-202 (RM) to US-60	B	$12.51	$4.44	4	1135	1212	2383	2545	59	29	0.018	3.5
SR-101 - Pima	SR-51 to FL Wright	C	$23.83	$8.00	3	828	894	1739	1877	62	34	0.013	6.7
SR-101 - Price	US-60 to Chandler Rd	C	$20.30	$8.54	3	716	752	1503	1580	60	32	0.015	5.7
I-10	Agua Fria River to SR-101	C	$13.42	$9.73	3	1047	1260	2200	2646	61	40	0.009	3.6
SR-101 - Pima	I-17 to SR-51	D	$24.42	$11.38	2	698	652	1465	1368	60	35	0.012	6.8
I-17	I-10 (Pap) to I-10 (Mar)	D	$64.56	$12.23	2	1193	1383	2506	2904	58	30	0.016	6.5
I-17	SR-74 to SR-101	D	$32.16	$12.85	2	845	760	1774	1595	62	40	0.009	9.0
I-17	Desert Hills to SR-74	D	$14.29	$14.67	2	561	486	1178	1020	63	36	0.012	4.0
SR-101 - Agua Fria	US-60 (Grand) to I-10	D	$34.54	$16.04	2	794	681	1667	1429	60	42	0.008	9.7
SR-101 - Price	Chandler to SR-202 (San)	D	$3.77	$17.85	2	411	291	863	612	60	32	0.015	1.1
SR-101 - Agua Fria	I-17 to 67th Ave	D	$19.15	$19.65	2	612	552	1285	1158	61	41	0.008	5.4
SR-202 - Red Mountain	SR-101 to SR-87	E	$12.76	$20.81	1	416	604	874	1269	61	40	0.009	3.6
I-10	SR-85 to Agua Fria River	E	$59.51	$30.01	1	426	449	895	943	63	43	0.007	16.0
SR-101 - Agua Fria	67th Ave to US-60 (Grand)	E	$37.07	$57.07	1	352	327	740	688	60	47	0.005	10.4
SR-202 - Santan	SR-101 (Price) to US-60	E	$66.46	$205.14	1	172	126	360	265	61	52	0.003	18.6
SR-202 - Santan	I-10 to SR-101 (Price)	E	$16.72	$211.70	1	219	248	459	520	60	54	0.002	4.7
SR-202 - Red Mountain	SR-87 to SR-60	E	$61.68	$275.16	1	150	176	316	369	61	55	0.002	17.3
SR-202 - South Mountain	I-10 (Pap) to I-10 (Mar)	E	$74.32	No Benefit	1	150	150	315	315	60	60	0.000	20.8
I-10	SR-202 (San) to Riggs Rd	E	$20.58	No Benefit	1	46	41	97	86	65	65	0.000	5.8

Table D-2
Summary of Additional HOV Lanes
Characteristics of Proposed MAG HOV Systems
[Alternative Evaluation]

	Corridor	Segment	Segment Length (miles)	Cost Effectiveness Total Cost (millions)	Cost Effectiveness Value ($/hr saved)	Cost-Benefit Ranking
Recommended New HOV Lanes (Post 2007)	SR-101 - Pima	Frank Lloyd Wright to SR-202	14.2	$50.6	$1.49	A
	I-10	79th Ave to 3rd Ave	8.4	$64.9	$1.94	A
	SR-101 - Price	SR-202 (Red Mountain) to US-60	3.5	$12.5	$4.44	B
	SR-101 - Pima	SR-51 to Frank Lloyd Wright	6.7	$23.8	$8.00	C
	SR-101 - Price	US-60 to Chandler Rd	5.7	$20.3	$8.54	C
	I-10	Agua Fria River to SR-101	3.6	$13.4	$9.73	C
	SR-101 - Pima	I-17 to SR-51	6.8	$24.4	$11.38	D
	I-17	I-10 (Papago) to I-10 (Maricopa)	6.5	$64.6	$12.23	D
	I-17	SR-74 (Carefree Hwy) to SR-101	9.0	$32.2	$12.85	D
	I-17	Desert Hills to SR-74 (Carefree Hwy)	4.0	$14.3	$14.67	D
	SR-101 - Agua Fria	US-60 (Grand Ave) to I-10	9.7	$34.5	$16.04	D
	SR-101 - Price	Chandler to SR-202 (Santan)	1.1	$3.8	$17.85	D
	SR-101 - Agua Fria	I-17 to 67th Ave	5.4	$19.2	$19.65	D
	Subtotal [A - D Ranked Lanes]		84.6	$378.5		
	SR-202 - Red Mountain	SR-101 to SR-87 (Country Club)	3.6	$12.8	$20.81	E
	I-10	SR-85 to Agua Fria River	16.0	$59.5	$30.01	E
	SR-101 - Agua Fria	67th Ave to US-60 (Grand Ave)	10.4	$37.1	$57.07	E
	Total [All New Recommended Lanes]		114.6	$487.9		
HOV Lanes Funded in Current Program	I-10 - Maricopa	Ray to Chandler Blvd	0.5	N/A	N/A	FY 2001
	SR-51 - Squaw Peak	I-10 to Shea Blvd	9.4	$42.6	N/A	FY 2003
	US-60 - Superstition	I-10 to Val Vista	12.0	$127.3	N/A	FY 2001
	Total [Funded Lanes]		21.9	$169.9		
HOV Lanes Planned but not Funded	SR-51	Shea Blvd to SR-101	6.7	$23.8	N/A	Planned
	US-60 - Superstition	Val Vista to Power Road	4.0	$42.9	N/A	Planned
	US-60 - Superstition	Power Road to SR-202	2.1	$14.1	N/A	Planned
	Total [Unfunded Lanes]		12.8	$80.8		
	Grand Total		149.3	$738.6		

Figure D-2
Alternative HOV System Recommendation and Cost Effectiveness Ranking

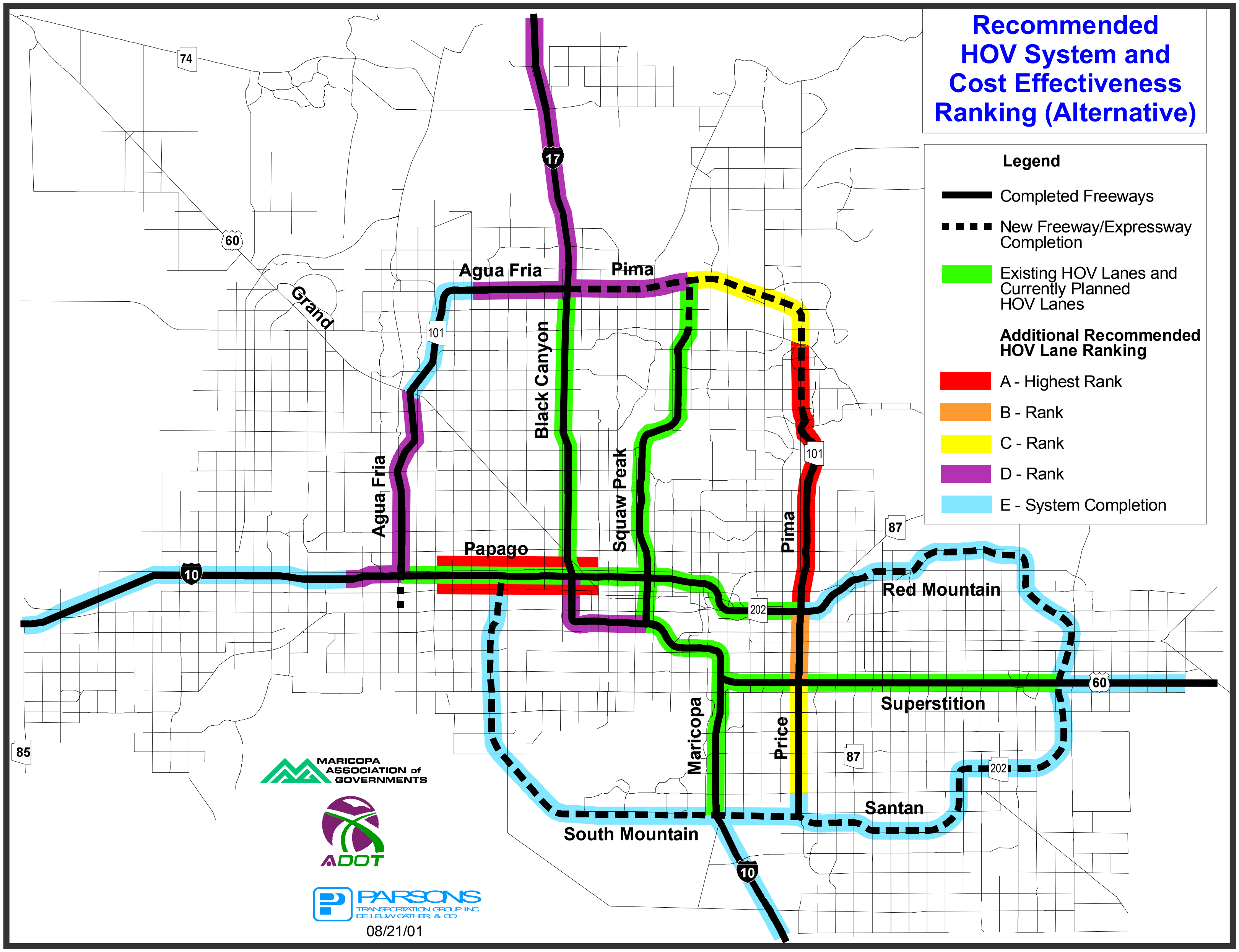


Table D-3 displays a summary of post-2007 recommended HOV freeway-to-freeway connectors, currently funded connectors, and a recommended HOV access ramp for the alternative analysis. It corresponds to Table F-3, in Appendix F, in the baseline cost-effectiveness analysis.

Two post-2007 freeway-to-freeway connectors feature improved cost-benefit rankings in the alternative analysis compared to their rankings in the baseline analysis:

- I-10 Papago east (of the interchange) and SR 101 Agua Fria north
- I-17 Black Canyon south and SR 101 Agua Fria west

Figure D-3 displays the recommended HOV system and cost effectiveness rankings for each HOV segment under the alternative analysis, similar to Figure D-2. The currently planned and additional recommended freeway-to-freeway connectors and direct access ramps have been added for this figure, however. Additionally recommended connectors are color coded by ranking in the same manner as the additionally recommended HOV segments. This figure corresponds to Figure 4-13 and Figure F-2 in the baseline analysis.

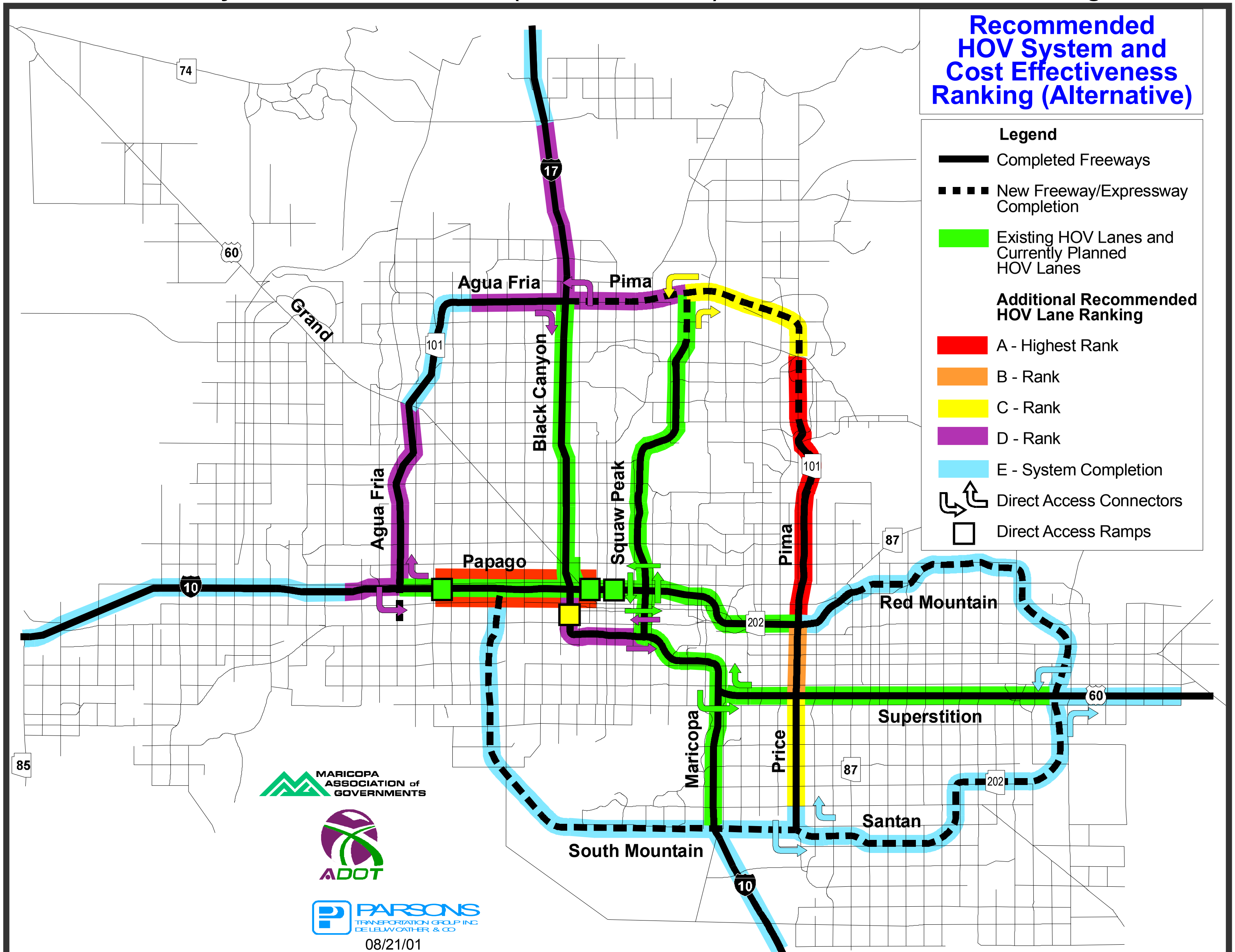
Examination of Figure D-3 indicates that this change in ranking is logical and matches what would be expected. Removal of the northwest to downtown diagonal Grand Avenue expressway (the freeway system "alternative") increases the demand on the Aqua Fria via Papago and the Aqua Fria via Black Canyon routes to/from downtown. Thus, the rank of these HOV lanes increases (e.g., reduced cost per travel time savings) in the 2020 model year analyzed. Likewise, the increased demand on the I-17/Black Canyon corridor raises the congestion level on I-17 north of the Aqua Fria and Pima freeways' convergence. This congestion on the northern section of I-17 then increases the ranking (e.g. decreases the cost-benefit value) for these HOV segments.

Grand Avenue as an express lane (HOT) diminishes the congestion ranking on the other HOV segments due to it providing congestion "relief" on those segments; thus, helping maintain an acceptable LOS. Its removal as an expressway causes increased congestion on the mainline loop; thus reducing their service level attractiveness. In summary, Grand Avenue as an expressway (HOT facility could be viable, but at significant cost as compared to HOV improvements on the mainlines only.

Table D-3 - Summary of HOV Freeway-to-Freeway Connectors Characteristics of Proposed MAG HOV System [Alternative Evaluation]

	Freeways Connected	Proposed Connections		Total Cost	Cost-Benefit Ranking
		From	To	(millions)	
Recommended HOV Connectors (Post 2007)	I-10 - Maricopa	East	West	$50	C
	I-17	West	East		
	SR-101 - Pima	East	South	$20	C
	SR-51	South	East		
	SR-101 - Agua Fria	North	East	$50	D
	I-10 - Papago	East	North		
	SR-101 - Agua Fria	West	South	$50	D
	I-17	South	West		
	Total [A-D Rajnked Connectors]			$170	
	SR-101 - Price	North	East	$20	E
	SR-202 - Santan	East	North		
	SR-202 - Santan	South	East	$20	E
	US-60 - Superstition	East	South		
	Total [All Planned Connectors]			$210	
Connectors Funded in Current Program	I-10 - Maricopa	North	East	$33	FY 2001
	US-60 - Superstition	East	North		
	I-10	South	North	$26	FY 2004
	I-51	North	South		
	Total [Funded Connectors]			$59	
Recommended HOV Access Ramp		Wash-ington & Jefferson	I-17	$50	
	Grand Total [All Connectors/Ramps]			$319	

Figure D-3
Alternative HOV System Recommendation (with Connectors) and Cost Effectiveness Ranking



APPENDIX E

Value Lanes Financial Feasibility Assessment

APPENDIX E

VALUE LANES FINANCIAL FEASIBILITY ASSESSMENT

The following discussion presents the purpose and methodology of this task, the patronage forecasts and net toll revenue analyses, the sensitivity analyses of key assumptions and factors, and a summary of the findings regarding financial feasibility.

The financial feasibility portion of the study provides an evaluation of the Value Lanes alternatives' financial feasibility. Specific features that are addressed for the operational and toll configurations include:

- definition of the analytical methodology and the assumptions used,
- estimation of costs,
- sensitivity analyses for related assumptions,
- conclusions regarding the overall financial feasibility, and
- evaluation of economic impacts.

The following major sections of this Appendix will document the:

1) methodology of the fiscal assessments and key assumptions,
2) details of the results of the Recommended HOT Case (Task 9),
3) details of the results for the Enhanced HOT Case (Task 7),
4) sensitivity analyses for key assumptions, and
5) evaluation of economic impacts of value lanes.

E.1 METHODOLOGY AND ASSUMPTIONS

The financial evaluation consists of developing a forecast of patronage and revenues in the Value Lanes based upon toll levels and traffic demand volumes, and estimating recurring costs of operation and maintenance (as well as the non-recurring toll system installation costs, and as appropriate the unfounded HOV lane construction costs). From these, the net revenues and cash flow over a period of years can be forecast which provides sufficient information to perform the financial evaluation. The fiscal viability assessment used the criterion: Could the Value Lane alternative, as conceived for this study, operate at a level of service sufficient to draw patronage to generate sufficient net revenues over a thirty year period to provide a significant source for recovery of a significant portion of the new lanes' construction costs? For simplicity, all revenue values in this section are shown as constant (i.e., year 2000) dollars.

E.1.1 Operational Concept and Policy Assumptions

A number of operational and policy issues affect the finances of the Value Lanes. The majority of these operating concepts are discussed in Section 2.4.4. For completeness, the key operational concepts for this fiscal analysis include:

- User Groups,
- Pay Groups,
- Operational management thresholds,
- Verification Provisions of Occupancy,
- Verification for Tolling,
- Toll Rates and Basis,
- Hours of Operation,
- Administration and Operation Management,
- Financing,
- Opening Year and Period of Operation to Evaluate,
- Toll Segments: Costs and Verification Lanes, and
- Income included in Revenue Estimates.

The options and selected policy approaches for each of these issues is presented in Table E-1. These policy selections were made for the purpose of this study's financial analysis. If Value Lanes are implemented in the MAG region, actual policies will be established prior to implementation by the appropriate decision-makers.

Table E-1: Value Lanes Operational and Policy Selections

Issue	**Options**	**Policy Selected** **<u>Selection Rationale:</u>**
User Groups: HOV- 3, HOV-2, SOVs	Are these the only groups being considered? Trucks, ILEVs, others?	Two axle vehicles and buses only. <u>Rationale</u>: maintain existing HOV policy
Pay Groups	Who should be free, who pays? Should HOVs pay less than SOVs	HOT 2 (SOVs tolled, HOV2+ free) <u>Rationale</u>: maintain existing HOV policy
Transponders Required	Toll payers, HOVs, or All	Toll Payers Only <u>Rationale</u>: Cost of issuing transponders ($30) and maintaining non-revenue accounts
Movements Served	Peak direction, off-peak direction	Tolling whenever lanes are open. <u>Rationale</u>: Operation automated for toll collection & toll violation enforcement. Simplified signing. Less motorist confusion.

Table E-1: Value Lanes Operational and Policy Selections

Issue	Options	Policy Selected __Selection Rationale:__
Operational Management Thresholds	Minimum and maximum volume per lane/hour	Minimum per lane: 500 veh/hour Maximum per lane: above LOS D 1500 vehicles/hour/lane for single lane; 1700 vehicles/hour/lane for two lanes*
Verification Provisions for Occupancy	Manual or Automated	Visual by DPS; include DPS HOV enforcement areas; citation by DPS and payment via courts
Verification for Tolling	Same as SR-91 CTPC or I-15 experience? Automated or semi-automated?	• Automated using transponders, remote monitoring, automated license plate capture of violators, citation by mail, payment of tolls and fines using DMV "holds" when needed. Toll verification lane(s) designated for toll payers for automation of license plate capture for newly constructed Value Lanes. • Manual for conversions.
Toll Rates	Fixed, variable by time of day, variable by time, fully dynamic	Fully dynamic with toll segment pricing that varies with congestion levels (lower congestion = lower rates). __Rationale__: Provides travel demand management to maintain LOS.
Toll Rate Basis	Per segment, per mile or per use	Toll concept is on a mileage basis in each toll segment, such that a toll transaction is priced from the mileage of each use/trip, at rates that vary with congestion in each toll segment. __Rationale__: High tolls only when congestion/demand is high.
Hours of Operation	24 hours, 14-16 hours or peak periods only	Tolling whenever lanes are open: • New Lanes (24-hours), and • Conversion Lanes (Peak Periods only) __Rationale__: Existing HOV lanes will maintain policy of usage. New Lanes will be used 24 hours to maximize use and controls.

Table E-1: Value Lanes Operational and Policy Selections

Issue	Options	Policy Selected Selection Rationale:
Administration and Operations Mgmt.	ADOT, Transportation Authority or 3rd party	Public Agency. Public-private partnership may be possible.
Financing	Public funds, private bonds backed by public agency, private bonds or combinations	Public funds augmented as needed by private bonds backed by public agency. Rationale: Lowest cost approach.
Opening Year and Period to Evaluate	Opening: 2005, 2008, 2010, later Period: 20, 25, 30 years	Open in 2010 with 30-year period (bond payback). Rationale: Earliest opening; Typical toll-backed bond payback period.
Toll Segments: Costs and Verification Lanes	Toll collection & verification equipment, verification lanes as well as signage needed for each toll segment	• **New:** Provide verification lane(s) for each toll segment to allow automation of violation enforcement • **Conversions:** Use existing lanes without toll verification lanes to minimize conversion costs • **All:** 2-mile toll segments assumed.
Income included in Revenue Estimates	Tolls, toll violations, HOV violations, or combination	Tolls and toll violation income only. Rationale: HOV violation fines allocated among agencies through separate legal basis.

* For HOV or HOT lanes, recommended maximum is 1500 vehicles/ lane/hour for one-lane facility and 1700 v/l/hr for two-lane facility in order to be at or above LOS D (see Table E-4). Recommend not allowing toll payers into HOT lanes when HOV volumes exceed 1400 vehicles per hour per lane for single lane, and 1600 vehicles per hour per lane for two lanes. This is because the toll rates become excessive when trying to limit toll payers to only 100 vehicles/lane/hour and dynamic pricing does not provide sufficient demand management control.

These Value Lanes policy selections form the basic operational concept for the financial analysis. This fiscal assessment analyzed a number of potential Value Lanes corridors.

E.1.2 Traffic Modeling Forecasts of Demand

The key measures of the financial viability of the Value Lanes are the patronage and revenue estimates that are based upon the traffic projections from the new MAG regional transportation forecasting model. For this study, the Value Lanes alternatives' traffic projections were developed by MAG with the concurrence and review of Parsons Transportation Group. The MAG traffic model was used to estimate patronage estimates for each corridor at various locations along each corridor in both travel directions for the years 2010 and 2020 during the AM and PM peak periods.

Patronage was estimated using variable pricing on each corridor. The toll patronage was iteratively determined by the MAG modelers by varying the toll rates until either an acceptable LOS was attained or HOT patronage was maximized. That is, if the HOT lane was congested (i.e., over the LOS D levels discussed above), then the toll rate was raised until the demand was reduced to at least LOS D in the HOT lanes. On the other hand, if the HOT lane was not congested, then the toll was lowered until the maximum toll and HOV patronage was achieved or until demand rose to LOS D levels.

MAG made model runs for a three-hour AM peak period (6:00 to 9:00 AM) and a three-hour PM peak period (3:00 to 6:00 PM) for both years using networks that represent the regional transportation plan for freeways and arterials.

The tabulated traffic forecasts in the Value Lanes for the six candidate corridors are provided below in Table E-2, for 2010 AM, 2010 Pm and 2020 AM and 2020 PM. The traffic forecasts show the resulting patronage for the candidate corridors that are defined in Table E-3.

E.1.3 Patronage and Level of Service Goal for Value Lanes

The key to the viability of the Value lanes is to maintain (if possible) a time saving incentive for the Value lane users. We estimate that an 8-20 mph differential in speed between the general-purpose lanes and the Value Lanes should provide a high value time savings incentive for a toll patron. For example, 10 minutes could be saved over a 15-mile trip, at a constant 45-mph speed versus 30-mph. And, since the average Value Lane user will perceive an even larger time saving, we conclude that there should be sufficient demand in 2010 to nearly fill (and in 2020 to more than fill) the Value Lanes during peak periods in the primary commute directions at between $0.10/mile and $0.40/mile toll rates. The issue for the MAG region Value Lanes is how to keep the toll payer patronage in the Value Lane down to maintain an acceptable level of service for the HOV and the toll-paying motorists. To that end, a goal of level of service (LOS) at or better than LOS D was set for the Value lane alternative. The basic definitions and relations between LOS and other freeway traffic measures are illustrated below. These are simplifications intended to assist the reader of this financial analysis. For details and exact definitions, please consult the Highway Capacity Manual.

Table E-2
Value Lane Model Results

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	AF
1																								[redacted]
2	Asgmt Description	Corrid or #	Flag	Loc	Dir	AMPK PERIOD CAPACITY * LANES	Total Am Pk Period HOV VMT (Non-Toll Run)	Avg HOV Vol for Non-Toll Run	non-toll remaining capacity (total possible toll vehicles)	non-toll v/c	Total Am Pk Period HOV VMT (Toll Run)	Avg HOV Vol for Toll Run	HOV Ratio (toll vs non-toll)	Avg HOV Lane Speed for Toll Run	Total Am Peak Period Toll VMT (Toll Run)	Avg Toll Vol for Toll Run	Total Volume on HOV Lane (Shared Ride + Toll Veh)	Remaining Capacity after toll run	Avg V/C on HOV lanes w/tolls	Lanes	Total HOV Lane Miles	Average Peak Toll Fee (cents per mile)	hbw drive-alone toll trips	
3	2020 Enhanced 4 modified per Sept 8, meeting (HOT LANES2)	8&9	2	Pima SB(Frank Lloyd Wright-SR202)	Inbound	5100	53,442	4,133	967	0.81	51,373	3,973	0.96		17,193	1,330	5,303	-203	1.04	1.0	12.9	65	183,362	
4		18	5	I-10 EB (Agua Fria-59th Ave)	Inbound	10200	17,651	3,724	6,476	0.37	17,474	3,686	0.99		19,590	4,133	7,819	2,381	0.77	2.0	9.5	30		
5		20	13	I-10 EB (59th Ave-I-17)	Inbound	10200	24,469	5,402	4,798	0.53	21,787	4,809	0.89		25,382	5,603	10,413	-213	1.02	2.0	9.1	45		
6		21	7	I-10 EB (I-17-Central)	Inbound	10200	8,174	5,542	4,658	0.54	6,443	4,368	0.79		6,987	4,737	9,105	1,095	0.89	2.0	3.0	40		
7		22	9	I-10 WB (SR51-Central)	Inbound	5100	2,983	1,714	3,386	0.34	2,303	1,324	0.77		4,524	2,600	3,924	1,176	0.77	1.0	1.7	10		
8		23	10	SR51 SB (Shea-I-10)	Inbound	5100	31,924	3,489	1,611	0.68	24,986	2,731	0.78		23,908	2,613	5,344	-244	1.05	1.0	9.2	45		
9		24	11	SR202 WB (Sky Harbor Blvd-SR51)	Inbound	5100	7,098	1,156	3,944	0.23	6,149	1,001	0.87		15,177	2,472	3,473	1,627	0.68	1.0	6.1	10		
10		19	15	I-17 SB Loop 101-I-10)	Inbound	5100	58,738	4,166	934	0.82	37,680	2,672	0.64		38,052	2,699	5,371	-271	1.05	1.0	14.1	40		
11		30	17	US60 WB (Gilbert-Dobson)	Inbound	5100	12,469	2,955	2,145	0.58	8,619	2,042	0.69		12,546	2,973	5,015	85	0.98	1.0	4.2	50		
12		29	19	US60 WB (Dobson-I-10)	Inbound	5100	12,645	2,143	2,957	0.42	10,841	1,837	0.86		14,466	2,452	4,289	811	0.84	1.0	5.9	30		
13		28	23	I-10 WB (US60-40th St)	Inbound	5100	4,100	1,806	3,294	0.35	3,692	1,626	0.90		6,447	2,840	4,467	633	0.88	1.0	2.3	30		
14		1	24	I-10 EB (Dysart-Agua Fria)	Inbound	5100	6,992	1,959	3,141	0.38	6,677	1,870	0.95		5,983	1,676	3,546	1,554	0.70	1.0	3.6	25		
15		6	33	Loop 101(I-17-SR51)	Inbound	5100	8,346	1,187	3,913	0.23	8,151	1,159	0.98		14,362	2,043	3,202	1,898	0.63	1.0	7.0	10		
16		7	34	Loop 101(Frank Lloyd Wright-SR51)	Inbound	5100	6,613	787	4,313	0.15	5,684	677	0.86		11,990	1,427	2,104	2,996	0.41	1.0	8.4	10		
17		16	39	I-17 (Maricopa Fwy-Papago Fwy)	Inbound	5100	6,550	1,006	4,094	0.20	6,304	968	0.96		7,714	1,185	2,153	2,947	0.42	1.0	6.5	10		
18		26	40	I-10 (I-17-SR202)	Inbound	5100	1,401	508	4,592	0.10	1,416	513	1.01		2,920	1,058	1,571	3,529	0.31	1.0	2.8	10		
19		27	42	I-10 (40th St-I-17)	Inbound	5100	5,195	1,665	3,435	0.33	4,918	1,576	0.95		7,895	2,530	4,107	993	0.81	1.0	3.1	20		
20		25	44	Red Mtn (Pima Fwy-Sky Harbor Blvd)	Inbound	5100	6,500	1,451	3,649	0.28	5,424	1,211	0.83		14,321	3,197	4,407	693	0.86	1.0	4.5	30		
21		11	48	Price Fwy (US60-Red Mtn Fwy)	Inbound	5100	5,742	1,397	3,703	0.27	4,828	1,175	0.84		11,588	2,819	3,994	1,106	0.78	1.0	4.1	15		
22		32	50	Maricopa Fwy (Santan Fwy-US60)	Inbound	5100	4,758	714	4,386	0.14	4,526	680	0.95		15,877	2,384	3,064	2,036	0.60	1.0	6.7	10		
23		12	52	Price Fwy (Chandler Blvd-US60)	Inbound	5100	3,833	709	4,391	0.14	3,624	670	0.95		11,104	2,052	2,722	2,378	0.53	1.0	5.4	10		
24		31	60	US60 (Power Rd-Gilbert Rd)	Inbound	5100	10,892	1,840	3,260	0.36	8,503	1,436	0.78		12,904	2,180	3,616	1,484	0.71	1.0	5.9	10		
25		3	66	SR51 SB (Loop 101-Shea)	Inbound	5100	14,929	2,235	2,865	0.44	12,847	1,923	0.86		12,786	1,914	3,837	1,263	0.75	1.0	6.7	30		
26							315,444	51,687	80,913		264,249	43,930			313,716						143			
27																								
28	2020 Enhanced 4 modified per Sept 8, meeting (us60 demo3)	8&9	2	Pima SB(Frank Lloyd Wright-SR202)	Inbound	5100	53,442	4,133	967	0.81	55,052	4,258	1.03	47.00	0	0	4,258	842	0.83	1.0	12.9	0	43224	
29		18	5	I-10 EB (Agua Fria-59th Ave)	Inbound	10200	17,651	3,724	6,476	0.37	17,690	3,732	1.00	60.00	0	0	3,732	6,468	0.37	2.0	9.5	0		
30		20	13	I-10 EB (59th Ave-I-17)	Inbound	10200	24,469	5,402	4,798	0.53	24,439	5,395	1.00	59.00	0	0	5,395	4,805	0.53	2.0	9.1	0		
31		21	7	I-10 EB (I-17-Central)	Inbound	10200	8,174	5,542	4,658	0.54	7,875	5,339	0.96	56.00	0	0	5,339	4,861	0.52	2.0	3.0	0		
32		22	9	I-10 WB (SR51-Central)	Inbound	5100	2,983	1,714	3,386	0.34	3,170	1,822	1.06	55.00	2,046	1,176	2,998	2,102	0.59	1.0	1.7	10		
33		23	10	SR51 SB (Shea-I-10)	Inbound	5100	31,924	3,489	1,611	0.68	32,129	3,511	1.01	56.00	0	0	3,511	1,589	0.69	1.0	9.2	0		
34		24	11	SR202 WB (Sky Harbor Blvd-SR51)	Inbound	5100	7,098	1,156	3,944	0.23	8,112	1,321	1.14	60.00	0	0	1,321	3,779	0.26	1.0	6.1	0		
35		19	15	I-17 SB Loop 101-I-10)	Inbound	5100	58,738	4,166	934	0.82	57,657	4,089	0.98	49.00	0	0	4,089	1,011	0.80	1.0	14.1	0		
36		30	17	US60 WB (Gilbert-Dobson)	Inbound	5100	12,469	2,955	2,145	0.58	9,200	2,180	0.74	31.00	12,149	2,879	5,059	41	0.99	1.0	4.2	50		
37		29	19	US60 WB (Dobson-I-10)	Inbound	5100	12,645	2,143	2,957	0.42	9,413	1,595	0.74	44.00	16,978	2,878	4,473	627	0.88	1.0	5.9	30		
38		28	23	I-10 WB (US60-40th St)	Inbound	5100	4,100	1,806	3,294	0.35	3,357	1,479	0.82	51.00	5,924	2,610	4,089	1,011	0.80	1.0	2.3	30		
39		1	24	I-10 EB (Dysart-Agua Fria)	Inbound	5100	6,992	1,959	3,141	0.38	7,018	1,966	1.00	60.00	0	0	1,966	3,134	0.39	1.0	3.6	0		
40		6	33	Loop 101(I-17-SR51)	Inbound	5100	8,346	1,187	3,913	0.23	9,056	1,288	1.09	60.00	0	0	1,288	3,812	0.25	1.0	7.0	0		
41		7	34	Loop 101(Frank Lloyd Wright-SR51)	Inbound	5100	6,613	787	4,313	0.15	6,788	808	1.03	62.00	0	0	808	4,292	0.16	1.0	8.4	0		
42		16	39	I-17 (Maricopa Fwy-Papago Fwy)	Inbound	5100	6,550	1,006	4,094	0.20	5,468	840	0.83	59.00	0	0	840	4,260	0.16	1.0	6.5	0		
43		26	40	I-10 (I-17-SR202)	Inbound	5100	1,401	508	4,592	0.10	1,229	445	0.88	60.00	4,885	1,770	2,215	2,885	0.43	1.0	2.8	10		
44		27	42	I-10 (40th St-I-17)	Inbound	5100	5,195	1,665	3,435	0.33	4,244	1,360	0.82	54.00	7,619	2,442	3,802	1,298	0.75	1.0	3.1	20		
45		25	44	Red Mtn (Pima Fwy-Sky Harbor Blvd)	Inbound	5100	6,500	1,451	3,649	0.28	7,478	1,669	1.15	61.00	0	0	1,669	3,431	0.33	1.0	4.5	0		
46		11	48	Price Fwy (US60-Red Mtn Fwy)	Inbound	5100	5,742	1,397	3,703	0.27	6,052	1,473	1.05	60.00	0	0	1,473	3,627	0.29	1.0	4.1	0		
47		32	50	Maricopa Fwy (Santan Fwy-US60)	Inbound	5100	4,758	714	4,386	0.14	4,665	700	0.98	60.00	0	0	700	4,400	0.14	1.0	6.7	0		
48		12	52	Price Fwy (Chandler Blvd-US60)	Inbound	5100	3,833	709	4,391	0.14	4,490	830	1.17	60.00	0	0	830	4,270	0.16	1.0	5.4	0		
49		31	60	US60 (Power Rd-Gilbert Rd)	Inbound	5100	10,892	1,840	3,260	0.36	8,543	1,443	0.78	55.00	10,735	1,813	3,256	1,844	0.64	1.0	5.9	20		
50		3	66	SR51 SB (Loop 101-Shea)		5100	14,929	2,235	2,865	0.44	15,351	2,298	1.03	60.00	0	0	2,298	2,802	0.45	1.0	6.7	0		
51							315,444	51,687	80,913		308,476	49,842	0.98		60,336	15,567	65,410	67,190			143			
52																								
53	2020 Enhanced 4 modified per Sept 8, meeting (sr51 demo3)	8&9	2	Pima SB(Frank Lloyd Wright-SR202)	Inbound	5100	53,442	4,133	967	0.81	57,194	4,423	1.07	35.00	0	0	4,423	677	0.87	1.0	12.9	0	15775	
54		18	5	I-10 EB (Agua Fria-59th Ave)	Inbound	10200	17,651	3,724	6,476	0.37	17,951	3,787	1.02	60.00	0	0	3,787	6,413	0.37	2.0	9.5	0		
55		20	13	I-10 EB (59th Ave-I-17)	Inbound	10200	24,469	5,402	4,798	0.53	24,962	5,510	1.02	59.00	0	0	5,510	4,690	0.54	2.0	9.1	0		
56		21	7	I-10 EB (I-17-Central)	Inbound	10200	8,174	5,542	4,658	0.54	8,308	5,633	1.02	56.00	0	0	5,633	4,567	0.55	2.0	3.0	0		
57		22	9	I-10 WB (SR51-Central)	Inbound	5100	2,983	1,714	3,386	0.34	2,824	1,623	0.95	57.00	0	0	1,623	3,477	0.32	1.0	1.7	0		
58		23	10	SR51 SB (Shea-I-10)	Inbound	5100	31,924	3,489	1,611	0.68	24,904	2,722	0.78	19.00	20,368	2,226	4,948	152	0.97	1.0	9.2	65		
59		24	11	SR202 WB (Sky Harbor Blvd-SR51)	Inbound	5100	7,098	1,156	3,944	0.23	7,668	1,249	1.08	60.00	0	0	1,249	3,851	0.24	1.0	6.1	0		
60		19	15	I-17 SB Loop 101-I-10)	Inbound	5100	58,738	4,166	934	0.82	61,786	4,382	1.05	38.00	0	0	4,382	718	0.86	1.0	14.1	0		
61		30	17	US60 WB (Gilbert-Dobson)	Inbound	5100	12,469	2,955	2,145	0.58	12,520	2,967	1.00	59.00	0	0	2,967	2,133	0.58	1.0	4.2	0		
62		29	19	US60 WB (Dobson-I-10)	Inbound	5100	12,645	2,143	2,957	0.42	12,560	2,129	0.99	60.00	0	0	2,129	2,971	0.42	1.0	5.9	0		
63		28	23	I-10 WB (US60-40th St)	Inbound	5100	4,100	1,806	3,294	0.35	4,077	1,796	0.99	60.00	0	0	1,796	3,304	0.35	1.0	2.3	0		
64		1	24	I-10 EB (Dysart-Agua Fria)	Inbound	5100	6,992	1,959	3,141	0.38	7,139	2,000	1.02	60.00	0	0	2,000	3,100	0.39	1.0	3.6	0		
65		6	33	Loop 101(I-17-SR51)	Inbound	5100	8,346	1,187	3,913	0.23	7,963	1,133	0.95	60.00	0	0	1,133	3,967	0.22	1.0	7.0	0		
66		7	34	Loop 101(Frank Lloyd Wright-SR51)	Inbound	5100	6,613	787	4,313	0.15	6,415	764	0.97	62.00	0	0	764	4,336	0.15	1.0	8.4	0		
67		16	39	I-17 (Maricopa Fwy-Papago Fwy)	Inbound	5100	6,550	1,006	4,094	0.20	6,312	970	0.96	59.00	0	0	970	4,130	0.19	1.0	6.5	0		
68		26	40	I-10 (I-17-SR202)	Inbound	5100	1,401	508	4,592	0.10	1,411	511	1.01	60.00	769	279	790	4,310	0.15	1.0	2.8	10		
69		27	42	I-10 (40th St-I-17)	Inbound	5100	5,195	1,665	3,435	0.33	5,154	1,652	0.99	60.00	0	0	1,652	3,448	0.32	1.0	3.1	0		
70		25	44	Red Mtn (Pima Fwy-Sky Harbor Blvd)	Inbound	5100	6,500	1,451	3,649	0.28	7,023	1,568	1.08	61.00	0	0	1,568	3,532	0.31	1.0	4.5	0		
71		11	48	Price Fwy (US60-Red Mtn Fwy)	Inbound	5100	5,742	1,397	3,703	0.27	5,762	1,402	1.00	60.00	0	0	1,402	3,698	0.27	1.0	4.1	0		
72		32	50	Maricopa Fwy (Santan Fwy-US60)	Inbound	5100	4,758	714	4,386	0.14	4,670	701	0.98	60.00	0	0	701	4,399	0.14	1.0	6.7	0		
73		12	52	Price Fwy (Chandler Blvd-US60)	Inbound	5100	3,833	709	4,391	0.14	3,780	699	0.99	60.00	0	0	699	4,401	0.14	1.0	5.4	0		
74		31	60	US60 (Power Rd-Gilbert Rd)	Inbound	5100	10,892	1,840	3,260	0.36	10,916	1,844	1.00	60.00	0	0	1,844	3,256	0.36	1.0	5.9	0		
75		3	66	SR51 SB (Loop 101-Shea)		5100	14,929	2,235	2,865	0.44	11,702	1,752	0.78	38.00	5,986	896	2,648	2,452	0.52	1.0	6.7	65		
76							315,444	51,687	80,913		313,001	51,215	0.99		27,123	3,401	54,615	77,985			143			
77																								

Table E-2
Value Lane Model Results

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	AF
78	2020 Enhanced 4 modified per Sept 8, meeting (pima/price demo2)	8&9	2	Pima SB(Frank Lloyd Wright-SR202)	Inbound	5100	53,442	4,133	967	0.81	38,629	2,988	0.72	30.00	25,043	1,937	4,924	176	0.97	1.0	12.9	60	33100	[redacted]
79		18	5	I-10 EB (Agua Fria-59th Ave)	Inbound	10200	17,651	3,724	6,476	0.37	18,178	3,835	1.03	60.00	0	0	3,835	6,365	0.38	2.0	9.5	0		
80		20	13	I-10 EB (59th Ave-I-17)	Inbound	10200	24,469	5,402	4,798	0.53	25,315	5,588	1.03	59.00	0	0	5,588	4,612	0.55	2.0	9.1	0		
81		21	7	I-10 EB (I-17-Central)	Inbound	10200	8,174	5,542	4,658	0.54	8,296	5,624	1.01	56.00	0	0	5,624	4,576	0.55	2.0	3.0	0		
82		22	9	I-10 WB (SR51-Central)	Inbound	5100	2,983	1,714	3,386	0.34	2,995	1,721	1.00	57.00	0	0	1,721	3,379	0.34	1.0	1.7	0		
83		23	10	SR51 SB (Shea-I-10)	Inbound	5100	31,924	3,489	1,611	0.68	36,833	4,025	1.15	47.00	0	0	4,025	1,075	0.79	1.0	9.2	0		
84		24	11	SR202 WB (Sky Harbor Blvd-SR51)	Inbound	5100	7,098	1,156	3,944	0.23	6,429	1,047	0.91	60.00	0	0	1,047	4,053	0.21	1.0	6.1	0		
85		19	15	I-17 SB Loop 101-I-10)	Inbound	5100	58,738	4,166	934	0.82	61,997	4,397	1.06	44.00	0	0	4,397	703	0.86	1.0	14.1	0		
86		30	17	US60 WB (Gilbert-Dobson)	Inbound	5100	12,469	2,955	2,145	0.58	12,473	2,956	1.00	59.00	0	0	2,956	2,144	0.58	1.0	4.2	0		
87		29	19	US60 WB (Dobson-I-10)	Inbound	5100	12,645	2,143	2,957	0.42	12,831	2,175	1.01	60.00	0	0	2,175	2,925	0.43	1.0	5.9	0		
88		28	23	I-10 WB (US60-40th St)	Inbound	5100	4,100	1,806	3,294	0.35	4,188	1,845	1.02	60.00	0	0	1,845	3,255	0.36	1.0	2.3	0		
89		1	24	I-10 EB (Dysart-Agua Fria)	Inbound	5100	6,992	1,959	3,141	0.38	7,138	1,999	1.02	60.00	0	0	1,999	3,101	0.39	1.0	3.6	0		
90		6	33	Loop 101(I-17-SR51)	Inbound	5100	8,346	1,187	3,913	0.23	6,383	908	0.76	60.00	0	0	908	4,192	0.18	1.0	7.0	0		
91		7	34	Loop 101(Frank Lloyd Wright-SR51)	Inbound	5100	6,613	787	4,313	0.15	6,965	829	1.05	62.00	0	0	829	4,271	0.16	1.0	8.4	0		
92		16	39	I-17 (Maricopa Fwy-Papago Fwy)	Inbound	5100	6,550	1,006	4,094	0.20	6,621	1,017	1.01	59.00	0	0	1,017	4,083	0.20	1.0	6.5	0		
93		26	40	I-10 (I-17-SR202)	Inbound	5100	1,401	508	4,592	0.10	1,440	522	1.03	60.00	0	0	522	4,578	0.10	1.0	2.8	0		
94		27	42	I-10 (40th St-I-17)	Inbound	5100	5,195	1,665	3,435	0.33	5,318	1,704	1.02	60.00	0	0	1,704	3,396	0.33	1.0	3.1	0		
95		25	44	Red Mtn (Pima Fwy-Sky Harbor Blvd)	Inbound	5100	6,500	1,451	3,649	0.28	5,650	1,261	0.87	61.00	0	0	1,261	3,839	0.25	1.0	4.5	0		
96		11	48	Price Fwy (US60-Red Mtn Fwy)	Inbound	5100	5,742	1,397	3,703	0.27	4,887	1,189	0.85	47.00	12,129	2,951	4,140	960	0.81	1.0	4.1	20		
97		32	50	Maricopa Fwy (Santan Fwy-US60)	Inbound	5100	4,758	714	4,386	0.14	4,722	709	0.99	60.00	0	0	709	4,391	0.14	1.0	6.7	0		
98		12	52	Price Fwy (Chandler Blvd-US60)	Inbound	5100	3,833	709	4,391	0.14	3,170	586	0.83	58.00	12,184	2,252	2,838	2,262	0.56	1.0	5.4	10		
99		31	60	US60 (Power Rd-Gilbert Rd)	Inbound	5100	10,892	1,840	3,260	0.36	10,769	1,819	0.99	60.00	0	0	1,819	3,281	0.36	1.0	5.9	0		
100		3	66	SR51 SB (Loop 101-Shea)		5100	14,929	2,235	2,865	0.44	17,540	2,626	1.17	58.00	0	0	2,626	2,474	0.51	1.0	6.7	0		
101							315,444	51,687	80,913		308,767	51,371	0.98		49,356	7,140	58,511	74,089			143			
102																								
103	2020 Enhanced 4 modified per Sept 8, meeting (SR202 demo3)	8&9	2	Pima SB(Frank Lloyd Wright-SR202)	Inbound	5100	53,442	4,133	967	0.81	54,061	4,181	1.01	51.00	0	0	4,181	919	0.82	1.0	12.9	0	31444	
104		18	5	I-10 EB (Agua Fria-59th Ave)	Inbound	10200	17,651	3,724	6,476	0.37	17,554	3,703	0.99	60.00	0	0	3,703	6,497	0.36	2.0	9.5	0		
105		20	13	I-10 EB (59th Ave-I-17)	Inbound	10200	24,469	5,402	4,798	0.53	23,982	5,294	0.98	59.00	0	0	5,294	4,906	0.52	2.0	9.1	0		
106		21	7	I-10 EB (I-17-Central)	Inbound	10200	8,174	5,542	4,658	0.54	6,753	4,578	0.83	57.00	0	0	4,578	5,622	0.45	2.0	3.0	0		
107		22	9	I-10 WB (SR51-Central)	Inbound	5100	2,983	1,714	3,386	0.34	2,673	1,536	0.90	42.00	3,820	2,195	3,732	1,368	0.73	1.0	1.7	15		
108		23	10	SR51 SB (Shea-I-10)	Inbound	5100	31,924	3,489	1,611	0.68	33,037	3,611	1.03	55.00	0	0	3,611	1,489	0.71	1.0	9.2	0		
109		24	11	SR202 WB (Sky Harbor Blvd-SR51)	Inbound	5100	7,098	1,156	3,944	0.23	5,507	897	0.78	44.00	16,360	2,664	3,561	1,539	0.70	1.0	6.1	30		
110		19	15	I-17 SB Loop 101-I-10)	Inbound	5100	58,738	4,166	934	0.82	57,783	4,098	0.98	49.00	0	0	4,098	1,002	0.80	1.0	14.1	0		
111		30	17	US60 WB (Gilbert-Dobson)	Inbound	5100	12,469	2,955	2,145	0.58	12,548	2,973	1.01	59.00	0	0	2,973	2,127	0.58	1.0	4.2	0		
112		29	19	US60 WB (Dobson-I-10)	Inbound	5100	12,645	2,143	2,957	0.42	13,112	2,222	1.04	60.00	0	0	2,222	2,878	0.44	1.0	5.9	0		
113		28	23	I-10 WB (US60-40th St)	Inbound	5100	4,100	1,806	3,294	0.35	4,342	1,913	1.06	60.00	0	0	1,913	3,187	0.38	1.0	2.3	0		
114		1	24	I-10 EB (Dysart-Agua Fria)	Inbound	5100	6,992	1,959	3,141	0.38	6,995	1,959	1.00	60.00	0	0	1,959	3,141	0.38	1.0	3.6	0		
115		6	33	Loop 101(I-17-SR51)	Inbound	5100	8,346	1,187	3,913	0.23	8,842	1,258	1.06	60.00	0	0	1,258	3,842	0.25	1.0	7.0	0		
116		7	34	Loop 101(Frank Lloyd Wright-SR51)	Inbound	5100	6,613	787	4,313	0.15	6,740	802	1.02	62.00	0	0	802	4,298	0.16	1.0	8.4	0		
117		16	39	I-17 (Maricopa Fwy-Papago Fwy)	Inbound	5100	6,550	1,006	4,094	0.20	6,860	1,054	1.05	59.00	0	0	1,054	4,046	0.21	1.0	6.5	0		
118		26	40	I-10 (I-17-SR202)	Inbound	5100	1,401	508	4,592	0.10	1,482	537	1.06	60.00	0	0	537	4,563	0.11	1.0	2.8	0		
119		27	42	I-10 (40th St-I-17)	Inbound	5100	5,195	1,665	3,435	0.33	5,517	1,768	1.06	60.00	0	0	1,768	3,332	0.35	1.0	3.1	0		
120		25	44	Red Mtn (Pima Fwy-Sky Harbor Blvd)	Inbound	5100	6,500	1,451	3,649	0.28	5,114	1,142	0.79	43.00	13,029	2,908	4,050	1,050	0.79	1.0	4.5	40		
121		11	48	Price Fwy (US60-Red Mtn Fwy)	Inbound	5100	5,742	1,397	3,703	0.27	5,481	1,334	0.95	60.00	0	0	1,334	3,766	0.26	1.0	4.1	0		
122		32	50	Maricopa Fwy (Santan Fwy-US60)	Inbound	5100	4,758	714	4,386	0.14	4,841	727	1.02	60.00	0	0	727	4,373	0.14	1.0	6.7	0		
123		12	52	Price Fwy (Chandler Blvd-US60)	Inbound	5100	3,833	709	4,391	0.14	3,660	677	0.95	60.00	0	0	677	4,423	0.13	1.0	5.4	0		
124		31	60	US60 (Power Rd-Gilbert Rd)	Inbound	5100	10,892	1,840	3,260	0.36	10,972	1,853	1.01	60.00	0	0	1,853	3,247	0.36	1.0	5.9	0		
125		3	66	SR51 SB (Loop 101-Shea)		5100	14,929	2,235	2,865	0.44	15,438	2,311	1.03	60.00	0	0	2,311	2,789	0.45	1.0	6.7	0		
126							315,444	51,687	80,913		313,294	50,429	0.99		33,209	7,768	58,197	74,403			143			
127																								
128	2010 modified per Sept 8, meeting (us60 demo2)	8&9	2	Pima SB(Frank Lloyd Wright-SR202)	Inbound	5100	24,333	1,882	3,218	0.37	24,708	1,911	1.02	63.00	0	0	1,911	3,189	0.37	1.0	12.9	0	33376	
129		18	5	I-10 EB (Agua Fria-59th Ave)	Inbound	5100	7,916	2,056	3,044	0.40	7,724	2,006	0.98	60.00	0	0	2,006	3,094	0.39	1.0	3.9	0		
130		20	13	I-10 EB (59th Ave-I-17)	Inbound	5100	12,866	2,840	2,260	0.56	12,847	2,836	1.00	59.00	0	0	2,836	2,264	0.56	1.0	4.5	0		
131		21	7	I-10 EB (I-17-Central)	Inbound	5100	6,214	3,908	1,192	0.77	5,851	3,680	0.94	50.00	0	0	3,680	1,420	0.72	1.0	1.6	0		
132		22	9	I-10 WB (SR51-Central)	Inbound	5100	4,260	2,448	2,652	0.48	4,162	2,392	0.98	44.00	1,245	716	3,107	1,993	0.61	1.0	1.7	20		
133		23	10	SR51 SB (Shea-I-10)	Inbound	5100	24,139	2,638	2,462	0.52	24,296	2,655	1.01	60.00	0	0	2,655	2,445	0.52	1.0	9.2	0		
134		24	11	SR202 WB (Sky Harbor Blvd-SR51)	Inbound	5100	7,014	1,259	3,841	0.25	9,070	1,628	1.29	60.00	0	0	1,628	3,472	0.32	1.0	5.6	0		
135		19	15	I-17 SB Loop 101-I-10)	Inbound	5100	29,317	2,433	2,667	0.48	27,690	2,298	0.94	60.00	0	0	2,298	2,802	0.45	1.0	12.1	0		
136		30	17	US60 WB (Gilbert-Dobson)	Inbound	5100	10,937	2,592	2,508	0.51	9,293	2,202	0.85	42.00	9,030	2,140	4,342	758	0.85	1.0	4.2	40		
137		29	19	US60 WB (Dobson-I-10)	Inbound	5100	14,021	2,376	2,724	0.47	10,373	1,758	0.74	36.00	13,131	2,226	3,984	1,116	0.78	1.0	5.9	40		
138		28	23	I-10 WB (US60-40th St)	Inbound	5100	7,217	3,179	1,921	0.62	5,301	2,335	0.73	21.00	6,390	2,815	5,150	-50	1.01	1.0	2.3	40		
139		26	40	I-10 (I-17-SR202)	Inbound	5100	4,897	1,774	3,326	0.35	3,546	1,285	0.72	55.00	3,590	1,301	2,586	2,514	0.51	1.0	2.8	40		
140		27	42	I-10 (40th St-I-17)	Inbound	5100	7,616	2,441	2,659	0.48	5,567	1,784	0.73	32.00	7,005	2,245	4,029	1,071	0.79	1.0	3.1	40		
141		25	44	Red Mtn (Pima Fwy-Sky Harbor Blvd)	Inbound	5100	5,012	1,377	3,723	0.27	6,659	1,829	1.33	60.00	0	0	1,829	3,271	0.36	1.0	3.6	0		
142		11	48	Price Fwy (US60-Red Mtn Fwy)	Inbound	5100	5,793	1,416	3,684	0.28	6,560	1,604	1.13	60.00	0	0	1,604	3,496	0.31	1.0	4.1	0		
143		32	50	Maricopa Fwy (Santan Fwy-US60)	Inbound	5100	5,860	1,097	4,003	0.22	4,843	907	0.83	60.00	0	0	907	4,193	0.18	1.0	5.3	0		
144		12	52	Price Fwy (Chandler Blvd-US60)	Inbound	5100	3,700	683	4,417	0.13	4,541	838	1.23	60.00	0	0	838	4,262	0.16	1.0	5.4	0		
145		31	60	US60 (Power Rd-Gilbert Rd)	Inbound	5100	11,123	1,879	3,221	0.37	9,770	1,650	0.88	42.00	11,733	1,982	3,632	1,468	0.71	1.0	5.9	25		
146		3	66	SR51 SB (Loop 101-Shea)		5100	8,523	1,359	3,741	0.27	8,652	1,380	1.02	60.00	0	0	1,380	3,720	0.27	1.0	6.3	0		
147							200,758	39,639	57,261		191,453	36,979	0.95		52,124	13,424	50,403	46,497			100			
148																								
149	2010 modified per Sept 8, meeting (sr51demo3)	8&9	2	Pima SB(Frank Lloyd Wright-SR202)	Inbound	5100	24,333	1,882	3,218	0.37	26,386	2,041	1.08	63.00	0	0	2,041	3,059	0.40	1.0	12.9	0	13094	
150		18	5	I-10 EB (Agua Fria-59th Ave)	Inbound	5100	7,916	2,056	3,044	0.40	7,959	2,067	1.01	60.00	0	0	2,067	3,033	0.41	1.0	3.9	0		
151		20	13	I-10 EB (59th Ave-I-17)	Inbound	5100	12,866	2,840	2,260	0.56	13,151	2,903	1.02	59.00	0	0	2,903	2,197	0.57	1.0	4.5	0		
152		21	7	I-10 EB (I-17-Central)	Inbound	5100	6,214	3,908	1,192	0.77	6,371	4,007	1.03	50.00	0	0	4,007	1,093	0.79	1.0	1.6	0		
153		22	9	I-10 WB (SR51-Central)	Inbound	5100	4,260	2,448	2,652	0.48	4,197	2,412	0.99	44.00	0	0	2,412	2,688	0.47	1.0	1.7	0		
154		23	10	SR51 SB (Shea-I-10)	Inbound	5100	24,139	2,638	2,462	0.52	20,356	2,225	0.84	60.00	20,087	2,195	4,420	680	0.87	1.0	9.2	55		
155		24	11	SR202 WB (Sky Harbor Blvd-SR51)	Inbound	5100	7,014	1,259	3,841	0.25	7,527	1,351	1.07	60.00	0	0	1,351	3,749	0.26	1.0	5.6	0		
156		19	15	I-17 SB Loop 101-I-10)	Inbound	5100	29,317	2,433	2,667	0.48	30,028	2,492	1.02	60.00	0	0	2,492	2,608	0.49	1.0	12.1	0		
157		30	17	US60 WB (Gilbert-Dobson)	Inbound	5100	10,937	2,592	2,508	0.51	10,930	2,590	1.00	42.00	0	0	2,590	2,510	0.51	1.0	4.2	0		
158		29	19	US60 WB (Dobson-I-10)	Inbound	5100	14,021	2,376	2,724	0.47	13,900	2,356	0.99	36.00	0	0	2,356	2,744	0.46	1.0	5.9	0		
159		28	23	I-10 WB (US60-40th St)	Inbound	5100	7,217	3,179	1,921	0.62	7,170	3,159	0.99	21.00	0	0	3,159	1,941	0.62	1.0	2.3	0		
160		26	40	I-10 (I-17-SR202)	Inbound	5100	4,897	1,774	3,326	0.35	4,916	1,781	1.00	55.00	39	14	1,795	3,305	0.35	1.0	2.8	10		
161		27	42	I-10 (40th St-I-17)	Inbound	5100	7,616	2,441	2,659	0.48	7,637	2,448	1.00	32.00	0	0	2,448	2,652	0.48	1.0	3.1	0		
162		25	44	Red Mtn (Pima Fwy-Sky Harbor Blvd)	Inbound	5100	5,012	1,377	3,723	0.27	5,389	1,480	1.08	60.00	0	0	1,480	3,620	0.29	1.0	3.6	0		

Table E-2
Value Lane Model Results

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	AF
163		11	48	Price Fwy (US60-Red Mtn Fwy)	Inbound	5100	5,793	1,416	3,684	0.28	5,733	1,402	0.99	60.00	0	0	1,402	3,698	0.27	1.0	4.1	0		[redacted]
164		32	50	Maricopa Fwy (Santan Fwy-US60)	Inbound	5100	5,860	1,097	4,003	0.22	5,741	1,075	0.98	60.00	0	0	1,075	4,025	0.21	1.0	5.3	0		
165		12	52	Price Fwy (Chandler Blvd-US60)	Inbound	5100	3,700	683	4,417	0.13	3,678	679	0.99	60.00	0	0	679	4,421	0.13	1.0	5.4	0		
166		31	60	US60 (Power Rd-Gilbert Rd)	Inbound	5100	11,123	1,879	3,221	0.37	11,133	1,881	1.00	42.00	0	0	1,881	3,219	0.37	1.0	5.9	0		
167		3	66	SR51 SB (Loop 101-Shea)		5100	8,523	1,359	3,741	0.27	7,371	1,176	0.86	60.00	5,827	929	2,105	2,995	0.41	1.0	6.3	50		
168							200,758	39,639	57,261		199,573	39,524	0.99		25,953	3,139	42,662	54,238			100			
169																								
170	2010 modified per Sept 8, meeting (pima/price demo2)	8&9	2	Pima SB(Frank Lloyd Wright-SR202)	Inbound	5100	24,333	1,882	3,218	0.37	20,984	1,623	0.86	63.00	30,167	2,333	3,956	1,144	0.78	1.0	12.9	40	28912	
171		18	5	I-10 EB (Agua Fria-59th Ave)	Inbound	5100	7,916	2,056	3,044	0.40	7,703	2,001	0.97	60.00	0	0	2,001	3,099	0.39	1.0	3.9	0		
172		20	13	I-10 EB (59th Ave-I-17)	Inbound	5100	12,866	2,840	2,260	0.56	12,899	2,847	1.00	59.00	0	0	2,847	2,253	0.56	1.0	4.5	0		
173		21	7	I-10 EB (I-17-Central)	Inbound	5100	6,214	3,908	1,192	0.77	6,222	3,913	1.00	50.00	0	0	3,913	1,187	0.77	1.0	1.6	0		
174		22	9	I-10 WB (SR51-Central)	Inbound	5100	4,260	2,448	2,652	0.48	4,177	2,401	0.98	44.00	0	0	2,401	2,699	0.47	1.0	1.7	0		
175		23	10	SR51 SB (Shea-I-10)	Inbound	5100	24,139	2,638	2,462	0.52	24,845	2,715	1.03	60.00	0	0	2,715	2,385	0.53	1.0	9.2	0		
176		24	11	SR202 WB (Sky Harbor Blvd-SR51)	Inbound	5100	7,014	1,259	3,841	0.25	6,373	1,144	0.91	60.00	0	0	1,144	3,956	0.22	1.0	5.6	0		
177		19	15	I-17 SB Loop 101-I-10)	Inbound	5100	29,317	2,433	2,667	0.48	28,859	2,395	0.98	60.00	0	0	2,395	2,705	0.47	1.0	12.1	0		
178		30	17	US60 WB (Gilbert-Dobson)	Inbound	5100	10,937	2,592	2,508	0.51	10,608	2,514	0.97	42.00	0	0	2,514	2,586	0.49	1.0	4.2	0		
179		29	19	US60 WB (Dobson-I-10)	Inbound	5100	14,021	2,376	2,724	0.47	14,032	2,378	1.00	36.00	0	0	2,378	2,722	0.47	1.0	5.9	0		
180		28	23	I-10 WB (US60-40th St)	Inbound	5100	7,217	3,179	1,921	0.62	7,214	3,178	1.00	21.00	0	0	3,178	1,922	0.62	1.0	2.3	0		
181		26	40	I-10 (I-17-SR202)	Inbound	5100	4,897	1,774	3,326	0.35	4,980	1,804	1.02	55.00	0	0	1,804	3,296	0.35	1.0	2.8	0		
182		27	42	I-10 (40th St-I-17)	Inbound	5100	7,616	2,441	2,659	0.48	7,658	2,454	1.01	32.00	0	0	2,454	2,646	0.48	1.0	3.1	0		
183		25	44	Red Mtn (Pima Fwy-Sky Harbor Blvd)	Inbound	5100	5,012	1,377	3,723	0.27	4,267	1,172	0.85	60.00	0	0	1,172	3,928	0.23	1.0	3.6	0		
184		11	48	Price Fwy (US60-Red Mtn Fwy)	Inbound	5100	5,793	1,416	3,684	0.28	4,617	1,129	0.80	60.00	12,513	3,059	4,188	912	0.82	1.0	4.1	15		
185		32	50	Maricopa Fwy (Santan Fwy-US60)	Inbound	5100	5,860	1,097	4,003	0.22	5,674	1,063	0.97	60.00	0	0	1,063	4,037	0.21	1.0	5.3	0		
186		12	52	Price Fwy (Chandler Blvd-US60)	Inbound	5100	3,700	683	4,417	0.13	2,884	532	0.78	60.00	8,944	1,650	2,182	2,918	0.43	1.0	5.4	15		
187		31	60	US60 (Power Rd-Gilbert Rd)	Inbound	5100	11,123	1,879	3,221	0.37	10,714	1,810	0.96	42.00	0	0	1,810	3,290	0.35	1.0	5.9	0		
188		3	66	SR51 SB (Loop 101-Shea)		5100	8,523	1,359	3,741	0.27	8,746	1,395	1.03	60.00	0	0	1,395	3,705	0.27	1.0	6.3	0		
189							200,758	39,639	57,261		193,456	38,469	0.96		51,624	7,043	45,511	51,389			100			
190																								
191	2010 modified per Sept 8, meeting (sr202 demo3)	8&9	2	Pima SB(Frank Lloyd Wright-SR202)	Inbound	5100	24,333	1,882	3,218	0.37	24,499	1,895	1.01	63.00	0	0	1,895	3,205	0.37	1.0	12.9	0	24603	
192		18	5	I-10 EB (Agua Fria-59th Ave)	Inbound	5100	7,916	2,056	3,044	0.40	7,699	2,000	0.97	60.00	0	0	2,000	3,100	0.39	1.0	3.9	0		
193		20	13	I-10 EB (59th Ave-I-17)	Inbound	5100	12,866	2,840	2,260	0.56	12,699	2,803	0.99	59.00	0	0	2,803	2,297	0.55	1.0	4.5	0		
194		21	7	I-10 EB (I-17-Central)	Inbound	5100	6,214	3,908	1,192	0.77	5,791	3,642	0.93	50.00	0	0	3,642	1,458	0.71	1.0	1.6	0		
195		22	9	I-10 WB (SR51-Central)	Inbound	5100	4,260	2,448	2,652	0.48	3,673	2,111	0.86	44.00	3,198	1,838	3,949	1,151	0.77	1.0	1.7	30		
196		23	10	SR51 SB (Shea-I-10)	Inbound	5100	24,139	2,638	2,462	0.52	24,568	2,685	1.02	60.00	0	0	2,685	2,415	0.53	1.0	9.2	0		
197		24	11	SR202 WB (Sky Harbor Blvd-SR51)	Inbound	5100	7,014	1,259	3,841	0.25	5,615	1,008	0.80	60.00	15,953	2,864	3,872	1,228	0.76	1.0	5.6	45		
198		19	15	I-17 SB Loop 101-I-10)	Inbound	5100	29,317	2,433	2,667	0.48	28,205	2,341	0.96	60.00	0	0	2,341	2,759	0.46	1.0	12.1	0		
199		30	17	US60 WB (Gilbert-Dobson)	Inbound	5100	10,937	2,592	2,508	0.51	10,896	2,582	1.00	42.00	0	0	2,582	2,518	0.51	1.0	4.2	0		
200		29	19	US60 WB (Dobson-I-10)	Inbound	5100	14,021	2,376	2,724	0.47	14,118	2,393	1.01	36.00	0	0	2,393	2,707	0.47	1.0	5.9	0		
201		28	23	I-10 WB (US60-40th St)	Inbound	5100	7,217	3,179	1,921	0.62	7,262	3,199	1.01	21.00	0	0	3,199	1,901	0.63	1.0	2.3	0		
202		26	40	I-10 (I-17-SR202)	Inbound	5100	4,897	1,774	3,326	0.35	4,913	1,780	1.00	55.00	0	0	1,780	3,320	0.35	1.0	2.8	0		
203		27	42	I-10 (40th St-I-17)	Inbound	5100	7,616	2,441	2,659	0.48	7,639	2,448	1.00	32.00	0	0	2,448	2,652	0.48	1.0	3.1	0		
204		25	44	Red Mtn (Pima Fwy-Sky Harbor Blvd)	Inbound	5100	5,012	1,377	3,723	0.27	3,813	1,048	0.76	60.00	10,554	2,899	3,947	1,153	0.77	1.0	3.6	50		
205		11	48	Price Fwy (US60-Red Mtn Fwy)	Inbound	5100	5,793	1,416	3,684	0.28	5,416	1,324	0.93	60.00	0	0	1,324	3,776	0.26	1.0	4.1	0		
206		32	50	Maricopa Fwy (Santan Fwy-US60)	Inbound	5100	5,860	1,097	4,003	0.22	5,687	1,065	0.97	60.00	0	0	1,065	4,035	0.21	1.0	5.3	0		
207		12	52	Price Fwy (Chandler Blvd-US60)	Inbound	5100	3,700	683	4,417	0.13	3,445	636	0.93	60.00	0	0	636	4,464	0.12	1.0	5.4	0		
208		31	60	US60 (Power Rd-Gilbert Rd)	Inbound	5100	11,123	1,879	3,221	0.37	10,999	1,858	0.99	42.00	0	0	1,858	3,242	0.36	1.0	5.9	0		
209		3	66	SR51 SB (Loop 101-Shea)		5100	8,523	1,359	3,741	0.27	8,659	1,381	1.02	60.00	0	0	1,381	3,719	0.27	1.0	6.3	0		
210							200,758	39,639	57,261		195,596	38,198	0.97		29,705	7,601	45,800	51,100			100			
211																								
212	2020 Enhanced 4 Scenario (w/I-10 Demofin)	9	2	Pima SB(Mayo Blvd-Shea)	Inbound	5100	39,805	4,041	1,059	0.79	41,210	4,184	1.04		0	0	4,184	916	0.82	1.0	9.9	0	41,467	
213		18	5	I-10 EB (Agua Fria-59th Ave)	Inbound	10200	20,606	4,347	5,853	0.43	17,279	3,645	0.84		23,242	4,903	8,549	1,651	0.84	2.0	9.5	45		
214		20	13	I-10 EB (59th Ave-I-17)	Inbound	10200	25,147	5,551	4,649	0.54	19,026	4,200	0.76		29,097	6,423	10,623	-423	1.04	2.0	9.1	45		
215		21	7	I-10 EB (I-17-Central)	Inbound	10200	8,335	5,651	4,549	0.55	6,835	4,634	0.82		7,702	5,222	9,856	344	0.97	2.0	3.0	30		
216		22	9	I-10 WB (SR51-Central)	Inbound	5100	2,827	1,625	3,475	0.32	2,836	1,630	1.00		0	0	1,630	3,470	0.32	1.0	1.7	0		
217		23	10	SR51 SB	Inbound	5100	44,509	2,812	2,288	0.55	46,172	2,917	1.04		0	0	2,917	2,183	0.57	1.0	15.8	0		
218		24	11	SR202 WB (Sky Harbor Blvd-SR51)	Inbound	5100	7,064	1,150	3,950	0.23	7,173	1,168	1.02		0	0	1,168	3,932	0.23	1.0	6.1	0		
219		19	15	I-17 SB Loop 101-I-10)	Inbound	10200	65,156	4,832	5,368	0.47	67,059	4,973	1.03		0	0	4,973	5,227	0.49	2.0	27.0	0		
220		30	17	US60 WB (Gilbert-Dobson)	Inbound	5100	12,676	3,004	2,096	0.59	12,785	3,030	1.01		0	0	3,030	2,070	0.59	1.0	4.2	0		
221		29	19	US60 WB (Dobson-I-10)	Inbound	5100	12,710	2,154	2,946	0.42	12,681	2,149	1.00		0	0	2,149	2,951	0.42	1.0	5.9	0		
222		28	23	I-10 WB (US60-40th St)	Inbound	5100	4,174	1,839	3,261	0.36	4,257	1,875	1.02		0	0	1,875	3,225	0.37	1.0	2.3	0		
223		1	24	I-10 EB (Dysart-Agua Fria)	Inbound	5100	8,726	2,444	2,656	0.48	7,828	2,193	0.90		0	0	2,193	2,907	0.43	1.0	3.6	0		
224		2	26	Agua Fria (Grand Ave-I-10)	Inbound	5100	12,339	1,273	3,827	0.25	10,876	1,122	0.88		0	0	1,122	3,978	0.22	1.0	9.7	0		
225		3	28	Agua Fria (75th Ave-Grand)	Inbound	5100	4,365	718	4,382	0.14	4,294	706	0.98		0	0	706	4,394	0.14	1.0	6.1	0		
226		4	31	Agua Fria (75th Ave-I-17)	Inbound	5100	8,242	1,351	3,749	0.26	9,659	1,583	1.17		0	0	1,583	3,517	0.31	1.0	6.1	0		
227		6	33	Loop 101(I-17-SR51)	Inbound	5100	8,429	1,199	3,901	0.24	9,291	1,322	1.10		0	0	1,322	3,778	0.26	1.0	7.0	0		
228		7	34	Loop 101(Mayo Blvd-SR51)	Inbound	5100	6,285	928	4,172	0.18	6,487	958	1.03		0	0	958	4,142	0.19	1.0	6.8	0		
229		5	36	I-17 (Carefree Hwy-Loop 101)	Inbound	5100	16,920	1,903	3,197	0.37	16,997	1,912	1.00		0	0	1,912	3,188	0.37	1.0	8.9	0		
230		16	39	I-17 (Maricopa Fwy-Papago Fwy)	Inbound	5100	6,628	1,018	4,082	0.20	6,624	1,018	1.00		0	0	1,018	4,082	0.20	1.0	6.5	0		
231		26	40	I-10 (I-17-SR202)	Inbound	5100	1,422	515	4,585	0.10	1,481	537	1.04		0	0	537	4,563	0.11	1.0	2.8	0		
232		27	42	I-10 (40th St-I-17)	Inbound	5100	5,308	1,701	3,399	0.33	5,401	1,731	1.02		0	0	1,731	3,369	0.34	1.0	3.1	0		
233		25	44	Red Mtn (Pima Fwy-Sky Harbor Blvd)	Inbound	5100	6,447	1,439	3,661	0.28	6,467	1,444	1.00		0	0	1,444	3,656	0.28	1.0	4.5	0		
234		10	46	Red Mtn (Gilbert Rd-Pima Fwy)	Inbound	5100	3,346	528	4,572	0.10	3,314	523	0.99		0	0	523	4,577	0.10	1.0	6.3	0		
235		11	48	Price Fwy (US60-Red Mtn Fwy)	Inbound	5100	5,938	1,445	3,655	0.28	5,878	1,430	0.99		0	0	1,430	3,670	0.28	1.0	4.1	0		
236		32	50	Maricopa Fwy (Santan Fwy-US60)	Inbound	5100	5,181	778	4,322	0.15	5,460	820	1.05		0	0	820	4,280	0.16	1.0	6.7	0		
237		12	52	Price Fwy (Santan Fwy-US60)	Inbound	5100	4,967	780	4,320	0.15	4,651	730	0.94		0	0	730	4,370	0.14	1.0	6.4	0		
238		14	54	Santan Fwy (Price Fwy-Maricopa Fwy)	Inbound	5100	1,354	272	4,828	0.05	1,411	284	1.04		0	0	284	4,816	0.06	1.0	5.0	0		
239		13	56	Maricopa Fwy (Germann Rd-Santan Fwy)	Inbound	5100	156	80	5,020	0.02	162	83	1.04		0	0	83	5,017	0.02	1.0	2.0	0		
240		15	58	Santan Fwy (McQueen Rd-Price Fwy)	Inbound	5100	1,745	516	4,584	0.10	1,717	508	0.98		0	0	508	4,592	0.10	1.0	3.4	0		
241		31	60	US60 (Hawes-Gilbert Rd)	Inbound	5100	14,029	1,751	3,349	0.34	14,297	1,785	1.02		0	0	1,785	3,315	0.35	1.0	8.0	0		
242		17	62	US60 (Tomahawk-Hawes Rd)	Inbound	5100	3,523	515	4,585	0.10	3,553	519	1.01		0	0	519	4,581	0.10	1.0	6.8	0		
243		8	64	Pima SB(Shea Blvd-SR202)	Inbound	5100	15,292	3,247	1,853	0.64	15,998	3,397	1.05		0	0	3,397	1,703	0.67	1.0	4.7	0		
244							383,651	61,409	122,191		379,159	59,009	0.99		60,041	16,548	75,557	108,043						
245																								
246	2010 demonstration w/2 lanes on I-10 (79th-5th Ave)	9	2	Pima SB	Inbound	0	0	0	0	0.00	0	0	0.00		0	0	0	0	0.00	0.0	0.0	0	34,009	
247		18	5	I-10 EB (Agua Fria-59th Ave)	Inbound	10200	7,913	2,055	8,145	0.20	6,238	1,620	0.79		21,894	5,687	7,307	2,893	0.72	2.0	7.7	20		

Table E-2
Value Lane Model Results

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	AF
248		20	13	I-10 EB (59th Ave-I-17)	Inbound	10200	12,868	2,841	7,359	0.28	10,284	2,270	0.80		32,640	7,205	9,475	725	0.93	2.0	9.1	20		
249		21	7	I-10 EB (I-17-Central)	Inbound	10200	6,417	4,036	6,164	0.40	5,643	3,549	0.88		7,350	4,623	8,172	2,028	0.80	2.0	3.2	20		
250		22	9	I-10 WB (SR51-Central)	Inbound	5100	4,025	2,313	2,787	0.45	4,014	2,307	1.00		0	0	2,307	2,793	0.45	1.0	1.7	0		
251		23	10	SR51 SB	Inbound	5100	22,473	2,456	2,644	0.48	22,409	2,449	1.00		0	0	2,449	2,651	0.48	1.0	9.2	0		
252		24	11	SR202 WB (Sky Harbor-SR51)	Inbound	5100	5,407	971	4,129	0.19	5,387	967	1.00		0	0	967	4,133	0.19	1.0	5.6	0		
253		19	15	I-17 SB (Agua Fria-I-10)	Inbound	5100	33,021	2,738	2,362	0.54	33,355	2,766	1.01		0	0	2,766	2,334	0.54	1.0	12.1	0		
254		30	17	US60 WB (Gilbert-Dobson)	Inbound	5100	12,620	2,991	2,109	0.59	12,452	2,951	0.99		0	0	2,951	2,149	0.58	1.0	4.2	0		
255		29	19	US60 WB (Dobson-I-10)	Inbound	5100	16,327	2,767	2,333	0.54	16,475	2,792	1.01		0	0	2,792	2,308	0.55	1.0	5.9	0		
256		28	23	I-10 WB (US60-40th St)	Inbound	5100	7,878	3,470	1,630	0.68	7,964	3,508	1.01		0	0	3,508	1,592	0.69	1.0	2.3	0		
257		1	24	I-10 EB (Dysart-Agua Fria)	Inbound	0	0	0	0	0.00	0	0	0.00		0	0	0	0	0.00	0.0	0.0	0		
258		2	26	Agua Fria (Grand Ave-I-10)	Inbound	0	0	0	0	0.00	0	0	0.00		0	0	0	0	0.00	0.0	0.0	0		
259		3	28	Agua Fria (75th Ave-Grand)	Inbound	0	0	0	0	0.00	0	0	0.00		0	0	0	0	0.00	0.0	0.0	0		
260		4	31	Agua Fria (75th Ave-I-17)	Inbound	0	0	0	0	0.00	0	0	0.00		0	0	0	0	0.00	0.0	0.0	0		
261		6	33	Loop 101(I-17-SR51)	Inbound	0	0	0	0	0.00	0	0	0.00		0	0	0	0	0.00	0.0	0.0	0		
262		7	34	Loop 101(Mayo Blvd-SR51)	Inbound	0	0	0	0	0.00	0	0	0.00		0	0	0	0	0.00	0.0	0.0	0		
263		5	36	I-17 (Carefree Hwy-Loop 101)	Inbound	0	0	0	0	0.00	0	0	0.00		0	0	0	0	0.00	0.0	0.0	0		
264		16	39	I-17 (Maricopa Fwy-Papago Fwy)	Inbound	0	0	0	0	0.00	0	0	0.00		0	0	0	0	0.00	0.0	0.0	0		
265		26	40	I-10 (I-17-SR202)	Inbound	5100	5,248	1,901	3,199	0.37	5,317	1,926	1.01		0	0	1,926	3,174	0.38	1.0	2.8	0		
266		27	42	I-10 (40th St-I-17)	Inbound	5100	8,183	2,623	2,477	0.51	8,281	2,654	1.01		0	0	2,654	2,446	0.52	1.0	3.1	0		
267		25	44	Red Mtn (Pima Fwy-Sky Harbor Blvd)	Inbound	5100	2,894	795	4,305	0.16	2,762	759	0.95		0	0	759	4,341	0.15	1.0	3.6	0		
268		10	46	Red Mtn (Gilbert Rd-Pima Fwy)	Inbound	0	0	0	0	0.00	0	0	0.00		0	0	0	0	0.00	0.0	0.0	0		
269		11	48	Price Fwy (US60-Red Mtn Fwy)	Inbound	0	0	0	0	0.00	0	0	0.00		0	0	0	0	0.00	0.0	0.0	0		
270		32	50	Maricopa Fwy (Santan Fwy-US60)	Inbound	5100	6,214	1,164	3,936	0.23	6,138	1,149	0.99		0	0	1,149	3,951	0.23	1.0	5.3	0		
271		12	52	Price Fwy (Santan Fwy-US60)	Inbound	0	0	0	0	0.00	0	0	0.00		0	0	0	0	0.00	0.0	0.0	0		
272		14	54	Santan Fwy (Price Fwy-Maricopa Fwy)	Inbound	0	0	0	0	0.00	0	0	0.00		0	0	0	0	0.00	0.0	0.0	0		
273		13	56	Maricopa Fwy (Germann Rd-Santan Fwy)	Inbound	0	0	0	0	0.00	0	0	0.00		0	0	0	0	0.00	0.0	0.0	0		
274		15	58	Santan Fwy (McQueen Rd-Price Fwy)	Inbound	0	0	0	0	0.00	0	0	0.00		0	0	0	0	0.00	0.0	0.0	0		
275		31	60	US60 (Hawes-Gilbert Rd)	Inbound	5100	11,759	1,986	3,114	0.39	11,811	1,995	1.00		0	0	1,995	3,105	0.39	1.0	5.9	0		
276		17	62	US60 (Tomahawk-Hawes Rd)	Inbound	0	0	0	0	0.00	0	0	0.00		0	0	0	0	0.00	0.0	0.0	0		
277		8	64	Pima SB(Shea Blvd-SR202)	Inbound	0	0	0	0	0.00	0	0	0.00		0	0	0	0	0.00	0.0	0.0	0		
278							163,247	35,107	56,693		158,530	33,664	0.97		61,884	17,515	51,178	40,622						
279																								
280																								

Table E-2
Value Lane Model Results

	AG	AH	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BH	BI	BJ	BK
1																				Total Toll Trips			
2	Flag	Loc	AMPK PERIOD CAPACITY * LANES	Total Am Pk Period HOV VMT (Non-Toll Run)	Avg HOV Vol for Non-Toll Run	non-toll remaining capacity (total possible toll vehicles)	non-toll v/c	Total Am Pk Period HOV VMT (Toll Run)	Avg HOV Vol for Toll Run	Total Am Peak Period Toll VMT (Toll Run)	HOV Ratio (toll vs non-toll)	Avg HOV Lane Speed for Toll Run	Avg Toll Vol for Toll Run	Total Volume on HOV Lane (Shared Ride + Toll Veh)	Remaining Capacity after toll run	Avg V/C on HOV lanes w/tolls	Lanes	Total Lane Miles	Average Peak Toll Fee (cents per mile)	Avg Cost Per Toll Trip (cents)	Avg Toll Trip Length ($)		
3	3	Pima NB(SR202-Frank Lloyd Wright)	5100	12,692	985	4,115	0.19	11,304	878	21,220	0.89		1,648	2,525	2,575	0.50	1.0	12.88	10	1,117,545	212,200		
4	6	I-10 WB (59th Ave-Agua Fria)	10200	4,647	978	9,222	0.10	3,473	731	4,424	0.75		931	1,663	8,537	0.16	2.0	9.50	10	587,700	44,240		
5	14	I-10 WB (I-17-59th Ave)	10200	6,158	1,359	8,841	0.13	4,920	1,086	6,562	0.80		1,449	2,535	7,665	0.25	2.0	9.06	10	1,142,190	65,620		
6	8	I-10 WB (Central-I-17)	10200	2,129	1,453	8,747	0.14	1,739	1,187	2,905	0.82		1,983	3,170	7,030	0.31	2.0	2.93	10	279,480	29,050		
7	4	I-10 EB (Central-SR51)	5100	7,695	4,422	678	0.87	4,706	2,705	4,327	0.61		2,487	5,191	-91	1.02	1.0	1.74	45	45,240	194,715		
8	20	SR51 NB (I-10-Shea)	5100	4,199	459	4,641	0.09	3,823	418	5,504	0.91		602	1,019	4,081	0.20	1.0	9.15	10	1,075,860	55,040		
9	12	SR202 EB (SR51-Sky Harbor Blvd)	5100	15,213	2,466	2,634	0.48	12,132	1,966	11,161	0.80		1,809	3,775	1,325	0.74	1.0	6.17	20	151,770	223,220		
10	16	I-17 NB (I-10-Loop 101)	5100	8,989	638	4,462	0.13	8,187	581	12,041	0.91		855	1,437	3,663	0.28	1.0	14.08	10	1,522,080	120,410		
11	18	US60 EB (Dobson-Gilbert)	5100	5,903	1,382	3,718	0.27	5,619	1,316	4,850	0.95		1,136	2,452	2,648	0.48	1.0	4.27	10	627,300	48,500		
12	21	US60 EB (I-10-Dobson)	5100	10,741	1,719	3,381	0.34	9,398	1,504	9,749	0.87		1,560	3,064	2,036	0.60	1.0	6.25	10	433,980	97,490		
13	22	I-10 EB (40th St-US60)	5100	6,516	3,308	1,792	0.65	5,783	2,936	3,256	0.89		1,653	4,588	512	0.90	1.0	1.97	25	193,410	81,400		
14	25	I-10 WB (Agua Fria-Dysart)	5100	2,416	671	4,429	0.13	1,975	549	2,915	0.82		810	1,358	3,742	0.27	1.0	3.60	10	149,575	29,150		
15	32	Loop 101(SR51-I-17)	5100	4,363	621	4,479	0.12	3,802	541	14,073	0.87		2,002	2,543	2,557	0.50	1.0	7.03	10	143,620	140,730		
16	35	Loop 101(SR51-Frank Lloyd Wright)	5100	17,345	2,072	3,028	0.41	16,891	2,018	16,484	0.97		1,969	3,987	1,113	0.78	1.0	8.37	10	119,900	164,840		
17	38	I-17 (Papago Fwy-Maricopa Fwy)	5100	17,477	2,656	2,444	0.52	17,482	2,657	12,846	1.00		1,952	4,609	491	0.90	1.0	6.58	25	77,140	321,150		
18	41	I-10 (SR202-I-17)	5100	4,701	1,703	3,397	0.33	4,009	1,453	3,453	0.85		1,251	2,704	2,396	0.53	1.0	2.76	10	29,200	34,530		
19	43	I-10 (I-17-40th St)	5100	11,003	3,527	1,573	0.69	9,274	2,972	5,293	0.84		1,696	4,669	431	0.92	1.0	3.12	30	157,900	158,790		
20	45	Red Mtn (Sky Harbor Blvd-Pima Fwy)	5100	3,916	872	4,228	0.17	3,598	801	4,210	0.92		938	1,739	3,361	0.34	1.0	4.49	10	429,630	42,100		
21	49	Price Fwy (Red Mtn Fwy-US60)	5100	11,148	2,719	2,381	0.53	10,650	2,598	5,977	0.96		1,458	4,055	1,045	0.80	1.0	4.10	25	173,820	149,425		
22	51	Maricopa Fwy (US60-Santan Fwy)	5100	6,269	901	4,199	0.18	6,941	997	4,960	1.11		713	1,710	3,390	0.34	1.0	6.96	10	158,770	49,600		
23	53	Price Fwy (US60-Chandler Blvd)	5100	8,027	1,476	3,624	0.29	6,929	1,274	6,995	0.86		1,286	2,560	2,540	0.50	1.0	5.44	10	111,040	69,950		
24	61	US60 (Gilbert Rd-Power Rd)	5100	4,406	753	4,347	0.15	4,279	731	3,290	0.97		562	1,294	3,806	0.25	1.0	5.85	10	129,040	32,900		
25	67	SR51 NB (Shea-Loop 101)	5100	883	132		0.03	771	115	902	0.87		135	250	4,850	0.05	1.0	6.68	10	383,580	9,020		
26				176,836	37,273	90,359		157,685		167,397										92,398	23,741	116,138	
27																						0.63	2.57
28	3	Pima NB(SR202-Frank Lloyd Wright)	5100	12,692	985	4,115	0.19	12,738	989	0	1.00	63.00	0	989	4,111	0.19	1.0	12.88	0	0	0		
29	6	I-10 WB (59th Ave-Agua Fria)	10200	4,647	978	9,222	0.10	4,616	972	0	0.99	60.00	0	972	9,228	0.10	2.0	9.50	0	0	0		
30	14	I-10 WB (I-17-59th Ave)	10200	6,158	1,359	8,841	0.13	6,237	1,377	0	1.01	60.00	0	1,377	8,823	0.13	2.0	9.06	0	0	0		
31	8	I-10 WB (Central-I-17)	10200	2,129	1,453	8,747	0.14	2,280	1,556	0	1.07	57.00	0	1,556	8,644	0.15	2.0	2.93	0	0	0		
32	4	I-10 EB (Central-SR51)	5100	7,695	4,422	678	0.87	6,038	3,470	2,769	0.78	29.00	1,591	5,061	39	0.99	1.0	1.74	40	20,460	110,760		
33	20	SR51 NB (I-10-Shea)	5100	4,199	459	4,641	0.09	3,933	430	0	0.94	60.00	0	430	4,670	0.08	1.0	9.15	0	0	0		
34	12	SR202 EB (SR51-Sky Harbor Blvd)	5100	15,213	2,466	2,634	0.48	15,972	2,589	0	1.05	58.00	0	2,589	2,511	0.51	1.0	6.17	0	0	0		
35	16	I-17 NB (I-10-Loop 101)	5100	8,989	638	4,462	0.13	8,902	632	0	0.99	60.00	0	632	4,468	0.12	1.0	14.08	0	0	0		
36	18	US60 EB (Dobson-Gilbert)	5100	5,903	1,382	3,718	0.27	5,634	1,319	4,554	0.95	59.00	1,067	2,386	2,714	0.47	1.0	4.27	10	607,450	45,540		
37	21	US60 EB (I-10-Dobson)	5100	10,741	1,719	3,381	0.34	8,388	1,342	11,729	0.78	53.00	1,877	3,219	1,881	0.63	1.0	6.25	15	509,340	175,935		
38	22	I-10 EB (40th St-US60)	5100	6,516	3,308	1,792	0.65	4,691	2,381	4,661	0.72	38.00	2,366	4,747	353	0.93	1.0	1.97	30	177,720	139,830		
39	25	I-10 WB (Agua Fria-Dysart)	5100	2,416	671	4,429	0.13	2,401	667	0	0.99	60.00	0	667	4,433	0.13	1.0	3.60	0	0	0		
40	32	Loop 101(SR51-I-17)	5100	4,363	621	4,479	0.12	4,371	622	0	1.00	60.00	0	622	4,478	0.12	1.0	7.03	0	0	0		
41	35	Loop 101(SR51-Frank Lloyd Wright)	5100	17,345	2,072	3,028	0.41	18,341	2,191	0	1.06	62.00	0	2,191	2,909	0.43	1.0	8.37	0	0	0		
42	38	I-17 (Papago Fwy-Maricopa Fwy)	5100	17,477	2,656	2,444	0.52	17,544	2,666	0	1.00	59.00	0	2,666	2,434	0.52	1.0	6.58	0	0	0		
43	41	I-10 (SR202-I-17)	5100	4,701	1,703	3,397	0.33	3,705	1,342	7,558	0.79	44.00	2,738	4,081	1,019	0.80	1.0	2.76	15	48,850	113,370		
44	43	I-10 (I-17-40th St)	5100	11,003	3,527	1,573	0.69	7,677	2,461	7,638	0.70	37.00	2,448	4,909	191	0.96	1.0	3.12	40	152,380	305,520		
45	45	Red Mtn (Sky Harbor Blvd-Pima Fwy)	5100	3,916	872	4,228	0.17	4,735	1,055	0	1.21	61.00	0	1,055	4,045	0.21	1.0	4.49	0	0	0		
46	49	Price Fwy (Red Mtn Fwy-US60)	5100	11,148	2,719	2,381	0.53	12,040	2,937	0	1.08	58.00	0	2,937	2,163	0.58	1.0	4.10	0	0	0		
47	51	Maricopa Fwy (US60-Santan Fwy)	5100	6,269	901	4,199	0.18	6,630	953	0	1.06	60.00	0	953	4,147	0.19	1.0	6.96	0	0	0		
48	53	Price Fwy (US60-Chandler Blvd)	5100	8,027	1,476	3,624	0.29	7,826	1,439	0	0.97	60.00	0	1,439	3,661	0.28	1.0	5.44	0	0	0		
49	61	US60 (Gilbert Rd-Power Rd)	5100	4,406	753	4,347	0.15	4,269	730	3,131	0.97	60.00	535	1,265	3,835	0.25	1.0	5.85	10	214,700	31,310		
50	67	SR51 NB (Shea-Loop 101)	5100	883	132		0.03	799	120	0	0.90	60.00	0	120	4,980	0.02	1.0	6.68	0	0	0		
51				176,836	37,273	90,359		169,767	34,238	42,040	0.92		12,622	46,861	85,739					17,309	9,223	26,532	
52																						0.61	5.32
53	3	Pima NB(SR202-Frank Lloyd Wright)	5100	12,692	985	4,115	0.19	12,849	998	0	1.01	63.00	0	998	4,102	0.20	1.0	12.88	0	0	0		
54	6	I-10 WB (59th Ave-Agua Fria)	10200	4,647	978	9,222	0.10	4,344	915	0	0.93	60.00	0	915	9,285	0.09	2.0	9.50	0	0	0		
55	14	I-10 WB (I-17-59th Ave)	10200	6,158	1,359	8,841	0.13	5,802	1,281	0	0.94	60.00	0	1,281	8,919	0.13	2.0	9.06	0	0	0		
56	8	I-10 WB (Central-I-17)	10200	2,129	1,453	8,747	0.14	1,986	1,356	0	0.93	57.00	0	1,356	8,844	0.13	2.0	2.93	0	0	0		
57	4	I-10 EB (Central-SR51)	5100	7,695	4,422	678	0.87	7,822	4,495	0	1.02	39.00	0	4,495	605	0.88	1.0	1.74	0	0	0		
58	20	SR51 NB (I-10-Shea)	5100	4,199	459	4,641	0.09	4,207	460	2,086	1.00	60.00	228	688	4,412	0.13	1.0	9.15	10	1,323,920	20,860		
59	12	SR202 EB (SR51-Sky Harbor Blvd)	5100	15,213	2,466	2,634	0.48	15,262	2,474	0	1.00	59.00	0	2,474	2,626	0.49	1.0	6.17	0	0	0		
60	16	I-17 NB (I-10-Loop 101)	5100	8,989	638	4,462	0.13	9,071	644	0	1.01	60.00	0	644	4,456	0.13	1.0	14.08	0	0	0		
61	18	US60 EB (Dobson-Gilbert)	5100	5,903	1,382	3,718	0.27	5,935	1,390	0	1.01	60.00	0	1,390	3,710	0.27	1.0	4.27	0	0	0		
62	21	US60 EB (I-10-Dobson)	5100	10,741	1,719	3,381	0.34	10,407	1,665	0	0.97	60.00	0	1,665	3,435	0.33	1.0	6.25	0	0	0		
63	22	I-10 EB (40th St-US60)	5100	6,516	3,308	1,792	0.65	6,340	3,218	0	0.97	59.00	0	3,218	1,882	0.63	1.0	1.97	0	0	0		
64	25	I-10 WB (Agua Fria-Dysart)	5100	2,416	671	4,429	0.13	2,319	644	0	0.96	60.00	0	644	4,456	0.13	1.0	3.60	0	0	0		
65	32	Loop 101(SR51-I-17)	5100	4,363	621	4,479	0.12	4,801	683	0	1.10	60.00	0	683	4,417	0.13	1.0	7.03	0	0	0		
66	35	Loop 101(SR51-Frank Lloyd Wright)	5100	17,345	2,072	3,028	0.41	18,532	2,214	0	1.07	61.00	0	2,214	2,886	0.43	1.0	8.37	0	0	0		
67	38	I-17 (Papago Fwy-Maricopa Fwy)	5100	17,477	2,656	2,444	0.52	18,277	2,778	0	1.05	58.00	0	2,778	2,322	0.54	1.0	6.58	0	0	0		
68	41	I-10 (SR202-I-17)	5100	4,701	1,703	3,397	0.33	3,998	1,449	3,195	0.85	48.00	1,158	2,606	2,494	0.51	1.0	2.76	25	7,690	79,875		
69	43	I-10 (I-17-40th St)	5100	11,003	3,527	1,573	0.69	10,677	3,422	0	0.97	59.00	0	3,422	1,678	0.67	1.0	3.12	0	0	0		
70	45	Red Mtn (Sky Harbor Blvd-Pima Fwy)	5100	3,916	872	4,228	0.17	3,891	867	0	0.99	61.00	0	867	4,233	0.17	1.0	4.49	0	0	0		
71	49	Price Fwy (Red Mtn Fwy-US60)	5100	11,148	2,719	2,381	0.53	11,519	2,810	0	1.03	58.00	0	2,810	2,290	0.55	1.0	4.10	0	0	0		
72	51	Maricopa Fwy (US60-Santan Fwy)	5100	6,269	901	4,199	0.18	6,218	893	0	0.99	60.00	0	893	4,207	0.18	1.0	6.96	0	0	0		
73	53	Price Fwy (US60-Chandler Blvd)	5100	8,027	1,476	3,624	0.29	8,135	1,495	0	1.01	60.00	0	1,495	3,605	0.29	1.0	5.44	0	0	0		
74	61	US60 (Gilbert Rd-Power Rd)	5100	4,406	753	4,347	0.15	4,445	760	0	1.01	60.00	0	760	4,340	0.15	1.0	5.85	0	0	0		
75	67	SR51 NB (Shea-Loop 101)	5100	883	132		0.03	942	141	252	1.07	60.00	38	179	4,921	0.04	1.0	6.68	10	389,090	2,520		
76				176,836	37,273	90,359		177,779	37,050	5,533	0.99		1,423	38,473	94,127					17,207	1,033	18,240	
77																						1.16	12.99

Table E-2
Value Lane Model Results

	AG	AH	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BH	BI	BJ	BK
78	3	Pima NB(SR202-Frank Lloyd Wright)	5100	12,692	985	4,115	0.19	11,189	869	20,879	0.88	61.00	1,621	2,490	2,610	0.49	1.0	12.88	10	1,502,580	208,790		
79	6	I-10 WB (59th Ave-Agua Fria)	10200	4,647	978	9,222	0.10	4,540	956	0	0.98	60.00	0	956	9,244	0.09	2.0	9.50	0	0	0		
80	14	I-10 WB (I-17-59th Ave)	10200	6,158	1,359	8,841	0.13	6,102	1,347	0	0.99	60.00	0	1,347	8,853	0.13	2.0	9.06	0	0	0		
81	8	I-10 WB (Central-I-17)	10200	2,129	1,453	8,747	0.14	2,121	1,448	0	1.00	57.00	0	1,448	8,752	0.14	2.0	2.93	0	0	0		
82	4	I-10 EB (Central-SR51)	5100	7,695	4,422	678	0.87	7,837	4,504	0	1.02	39.00	0	4,504	596	0.88	1.0	1.74	0	0	0		
83	20	SR51 NB (I-10-Shea)	5100	4,199	459	4,641	0.09	4,210	460	0	1.00	60.00	0	460	4,640	0.09	1.0	9.15	0	0	0		
84	12	SR202 EB (SR51-Sky Harbor Blvd)	5100	15,213	2,466	2,634	0.48	16,303	2,642	0	1.07	58.00	0	2,642	2,458	0.52	1.0	6.17	0	0	0		
85	16	I-17 NB (I-10-Loop 101)	5100	8,989	638	4,462	0.13	9,139	649	0	1.02	60.00	0	649	4,451	0.13	1.0	14.08	0	0	0		
86	18	US60 EB (Dobson-Gilbert)	5100	5,903	1,382	3,718	0.27	5,995	1,404	0	1.02	60.00	0	1,404	3,696	0.28	1.0	4.27	0	0	0		
87	21	US60 EB (I-10-Dobson)	5100	10,741	1,719	3,381	0.34	12,468	1,995	0	1.16	60.00	0	1,995	3,105	0.39	1.0	6.25	0	0	0		
88	22	I-10 EB (40th St-US60)	5100	6,516	3,308	1,792	0.65	7,530	3,822	0	1.16	54.00	0	3,822	1,278	0.75	1.0	1.97	0	0	0		
89	25	I-10 WB (Agua Fria-Dysart)	5100	2,416	671	4,429	0.13	2,395	665	0	0.99	60.00	0	665	4,435	0.13	1.0	3.60	0	0	0		
90	32	Loop 101(SR51-I-17)	5100	4,363	621	4,479	0.12	4,186	595	0	0.96	60.00	0	595	4,505	0.12	1.0	7.03	0	0	0		
91	35	Loop 101(SR51-Frank Lloyd Wright)	5100	17,345	2,072	3,028	0.41	12,549	1,499	0	0.72	62.00	0	1,499	3,601	0.29	1.0	8.37	0	0	0		
92	38	I-17 (Papago Fwy-Maricopa Fwy)	5100	17,477	2,656	2,444	0.52	19,639	2,985	0	1.12	58.00	0	2,985	2,115	0.59	1.0	6.58	0	0	0		
93	41	I-10 (SR202-I-17)	5100	4,701	1,703	3,397	0.33	5,224	1,893	0	1.11	60.00	0	1,893	3,207	0.37	1.0	2.76	0	0	0		
94	43	I-10 (I-17-40th St)	5100	11,003	3,527	1,573	0.69	12,672	4,062	0	1.15	51.00	0	4,062	1,038	0.80	1.0	3.12	0	0	0		
95	45	Red Mtn (Sky Harbor Blvd-Pima Fwy)	5100	3,916	872	4,228	0.17	4,434	988	0	1.13	61.00	0	988	4,112	0.19	1.0	4.49	0	0	0		
96	49	Price Fwy (Red Mtn Fwy-US60)	5100	11,148	2,719	2,381	0.53	8,630	2,105	7,035	0.77	50.00	1,716	3,821	1,279	0.75	1.0	4.10	25	242,580	175,875		
97	51	Maricopa Fwy (US60-Santan Fwy)	5100	6,269	901	4,199	0.18	6,980	1,003	0	1.11	60.00	0	1,003	4,097	0.20	1.0	6.96	0	0	0		
98	53	Price Fwy (US60-Chandler Blvd)	5100	8,027	1,476	3,624	0.29	6,939	1,276	6,812	0.86	60.00	1,252	2,528	2,572	0.50	1.0	5.44	10	121,840	68,120		
99	61	US60 (Gilbert Rd-Power Rd)	5100	4,406	753	4,347	0.15	4,476	765	0	1.02	60.00	0	765	4,335	0.15	1.0	5.85	0	0	0		
100	67	SR51 NB (Shea-Loop 101)	5100	883	132		0.03	850	127	0	0.96	60.00	0	127	4,973	0.02	1.0	6.68	0	0	0		
101				176,836	37,273	90,359		176,408	38,058	34,726	1.02		4,589	42,647	89,953					18,670	4,528	23,198	
102																						0.70	6.82
103	3	Pima NB(SR202-Frank Lloyd Wright)	5100	12,692	985	4,115	0.19	12,712	987	0	1.00	63.00	0	987	4,113	0.19	1.0	12.88	0	0	0		
104	6	I-10 WB (59th Ave-Agua Fria)	10200	4,647	978	9,222	0.10	4,612	971	0	0.99	60.00	0	971	9,229	0.10	2.0	9.50	0	0	0		
105	14	I-10 WB (I-17-59th Ave)	10200	6,158	1,359	8,841	0.13	6,050	1,336	0	0.98	60.00	0	1,336	8,864	0.13	2.0	9.06	0	0	0		
106	8	I-10 WB (Central-I-17)	10200	2,129	1,453	8,747	0.14	1,966	1,342	0	0.92	57.00	0	1,342	8,858	0.13	2.0	2.93	0	0	0		
107	4	I-10 EB (Central-SR51)	5100	7,695	4,422	678	0.87	4,996	2,871	3,631	0.65	31.00	2,087	4,958	142	0.97	1.0	1.74	55	57,300	199,705		
108	20	SR51 NB (I-10-Shea)	5100	4,199	459	4,641	0.09	4,271	467	0	1.02	60.00	0	467	4,633	0.09	1.0	9.15	0	0	0		
109	12	SR202 EB (SR51-Sky Harbor Blvd)	5100	15,213	2,466	2,634	0.48	10,385	1,683	15,260	0.68	38.00	2,473	4,156	944	0.81	1.0	6.17	40	490,800	610,400		
110	16	I-17 NB (I-10-Loop 101)	5100	8,989	638	4,462	0.13	8,941	635	0	0.99	60.00	0	635	4,465	0.12	1.0	14.08	0	0	0		
111	18	US60 EB (Dobson-Gilbert)	5100	5,903	1,382	3,718	0.27	6,045	1,416	0	1.02	60.00	0	1,416	3,684	0.28	1.0	4.27	0	0	0		
112	21	US60 EB (I-10-Dobson)	5100	10,741	1,719	3,381	0.34	11,350	1,816	0	1.06	60.00	0	1,816	3,284	0.36	1.0	6.25	0	0	0		
113	22	I-10 EB (40th St-US60)	5100	6,516	3,308	1,792	0.65	6,866	3,485	0	1.05	57.00	0	3,485	1,615	0.68	1.0	1.97	0	0	0		
114	25	I-10 WB (Agua Fria-Dysart)	5100	2,416	671	4,429	0.13	2,406	668	0	1.00	60.00	0	668	4,432	0.13	1.0	3.60	0	0	0		
115	32	Loop 101(SR51-I-17)	5100	4,363	621	4,479	0.12	4,431	630	0	1.02	60.00	0	630	4,470	0.12	1.0	7.03	0	0	0		
116	35	Loop 101(SR51-Frank Lloyd Wright)	5100	17,345	2,072	3,028	0.41	18,124	2,165	0	1.04	62.00	0	2,165	2,935	0.42	1.0	8.37	0	0	0		
117	38	I-17 (Papago Fwy-Maricopa Fwy)	5100	17,477	2,656	2,444	0.52	21,970	3,339	0	1.26	57.00	0	3,339	1,761	0.65	1.0	6.58	0	0	0		
118	41	I-10 (SR202-I-17)	5100	4,701	1,703	3,397	0.33	4,469	1,619	0	0.95	60.00	0	1,619	3,481	0.32	1.0	2.76	0	0	0		
119	43	I-10 (I-17-40th St)	5100	11,003	3,527	1,573	0.69	11,862	3,802	0	1.08	55.00	0	3,802	1,298	0.75	1.0	3.12	0	0	0		
120	45	Red Mtn (Sky Harbor Blvd-Pima Fwy)	5100	3,916	872	4,228	0.17	3,132	698	5,956	0.80	60.00	1,327	2,024	3,076	0.40	1.0	4.49	25	521,160	148,900		
121	49	Price Fwy (Red Mtn Fwy-US60)	5100	11,148	2,719	2,381	0.53	11,087	2,704	0	0.99	59.00	0	2,704	2,396	0.53	1.0	4.10	0	0	0		
122	51	Maricopa Fwy (US60-Santan Fwy)	5100	6,269	901	4,199	0.18	6,377	916	0	1.02	60.00	0	916	4,184	0.18	1.0	6.96	0	0	0		
123	53	Price Fwy (US60-Chandler Blvd)	5100	8,027	1,476	3,624	0.29	8,086	1,486	0	1.01	60.00	0	1,486	3,614	0.29	1.0	5.44	0	0	0		
124	61	US60 (Gilbert Rd-Power Rd)	5100	4,406	753	4,347	0.15	4,502	770	0	1.02	60.00	0	770	4,330	0.15	1.0	5.85	0	0	0		
125	67	SR51 NB (Shea-Loop 101)	5100	883	132		0.03	824	123	0	0.93	60.00	0	123	4,977	0.02	1.0	6.68	0	0	0		
126				176,836	37,273	90,359		175,464	35,930	24,847	0.96		5,887	41,816	90,784					10,693	9,590	20,283	
127																						0.65	6.64
128	3	Pima NB(SR202-Frank Lloyd Wright)	5100	9,084	705	4,395	0.14	8,904	691	0	0.98	63.00	0	691	4,409	0.14	1.0	12.88	0	0	0		
129	6	I-10 WB (59th Ave-Agua Fria)	5100	3,338	865	4,235	0.17	3,211	832	0	0.96	60.00	0	832	4,268	0.16	1.0	3.86	0	0	0		
130	14	I-10 WB (I-17-59th Ave)	5100	5,904	1,306	3,794	0.26	5,741	1,270	0	0.97	60.00	0	1,270	3,830	0.25	1.0	4.52	0	0	0		
131	8	I-10 WB (Central-I-17)	5100	2,938	1,848	3,252	0.36	2,863	1,801	0	0.97	57.00	0	1,801	3,299	0.35	1.0	1.59	0	0	0		
132	4	I-10 EB (Central-SR51)	5100	6,306	3,624	1,476	0.71	5,383	3,094	2,314	0.85	39.00	1,330	4,424	676	0.87	1.0	1.74	10	24,900	23,140		
133	20	SR51 NB (I-10-Shea)	5100	3,344	365	4,735	0.07	2,975	325	0	0.89	60.00	0	325	4,775	0.06	1.0	9.15	0	0	0		
134	12	SR202 EB (SR51-Sky Harbor Blvd)	5100	8,902	1,590	3,510	0.31	9,933	1,774	0	1.12	60.00	0	1,774	3,326	0.35	1.0	5.60	0	0	0		
135	16	I-17 NB (I-10-Loop 101)	5100	5,798	491	4,609	0.10	5,589	474	0	0.96	60.00	0	474	4,626	0.09	1.0	11.80	0	0	0		
136	18	US60 EB (Dobson-Gilbert)	5100	2,635	617	4,483	0.12	2,520	590	1,219	0.96	60.00	285	876	4,224	0.17	1.0	4.27	10	361,200	12,190		
137	21	US60 EB (I-10-Dobson)	5100	5,138	822	4,278	0.16	3,898	624	4,546	0.76	60.00	727	1,351	3,749	0.26	1.0	6.25	20	525,240	90,920		
138	22	I-10 EB (40th St-US60)	5100	3,430	1,741	3,359	0.34	2,775	1,409	3,950	0.81	51.00	2,005	3,414	1,686	0.67	1.0	1.97	20	255,600	79,000		
139	41	I-10 (SR202-I-17)	5100	6,602	2,392	2,708	0.47	5,489	1,989	5,372	0.83	51.00	1,946	3,935	1,165	0.77	1.0	2.76	20	143,600	107,440		
140	43	I-10 (I-17-40th St)	5100	6,849	2,195	2,905	0.43	5,570	1,785	7,390	0.81	42.00	2,369	4,154	946	0.81	1.0	3.12	20	280,200	147,800		
141	45	Red Mtn (Sky Harbor Blvd-Pima Fwy)	5100	2,441	672	4,428	0.13	3,007	828	0	1.23	60.00	0	828	4,272	0.16	1.0	3.63	0	0	0		
142	49	Price Fwy (Red Mtn Fwy-US60)	5100	5,902	1,443	3,657	0.28	6,317	1,544	0	1.07	60.00	0	1,544	3,556	0.30	1.0	4.09	0	0	0		
143	51	Maricopa Fwy (US60-Santan Fwy)	5100	2,836	504	4,596	0.10	2,594	461	0	0.91	60.00	0	461	4,639	0.09	1.0	5.63	0	0	0		
144	53	Price Fwy (US60-Chandler Blvd)	5100	3,787	696	4,404	0.14	3,758	691	0	0.99	60.00	0	691	4,409	0.14	1.0	5.44	0	0	0		
145	61	US60 (Gilbert Rd-Power Rd)	5100	1,796	307	4,793	0.06	1,717	294	860	0.96	60.00	147	441	4,659	0.09	1.0	5.85	10	293,325	8,600		
146	67	SR51 NB (Shea-Loop 101)	5100	400	64	5,036	0.01	360	58	0	0.90	61.00	0	58	5,042	0.01	1.0	6.26	0	0	0		
147				87,430	22,248	74,652		82,604	20,532	25,651	0.92		8,810	29,342	67,558					18,841	4,691	23,532	
148																						0.71	4.04
149	3	Pima NB(SR202-Frank Lloyd Wright)	5100	9,084	705	4,395	0.14	8,988	698	0	0.99	63.00	0	698	4,402	0.14	1.0	12.88	0	0	0		
150	6	I-10 WB (59th Ave-Agua Fria)	5100	3,338	865	4,235	0.17	3,301	855	0	0.99	60.00	0	855	4,245	0.17	1.0	3.86	0	0	0		
151	14	I-10 WB (I-17-59th Ave)	5100	5,904	1,306	3,794	0.26	5,836	1,291	0	0.99	60.00	0	1,291	3,809	0.25	1.0	4.52	0	0	0		
152	8	I-10 WB (Central-I-17)	5100	2,938	1,848	3,252	0.36	2,893	1,819	0	0.98	57.00	0	1,819	3,281	0.36	1.0	1.59	0	0	0		
153	4	I-10 EB (Central-SR51)	5100	6,306	3,624	1,476	0.71	6,420	3,690	0	1.02	39.00	0	3,690	1,410	0.72	1.0	1.74	0	0	0		
154	20	SR51 NB (I-10-Shea)	5100	3,344	365	4,735	0.07	3,337	365	304	1.00	60.00	33	398	4,702	0.08	1.0	9.15	10	1,104,785	3,040		
155	12	SR202 EB (SR51-Sky Harbor Blvd)	5100	8,902	1,590	3,510	0.31	8,853	1,581	0	0.99	60.00	0	1,581	3,519	0.31	1.0	5.60	0	0	0		
156	16	I-17 NB (I-10-Loop 101)	5100	5,798	491	4,609	0.10	5,691	482	0	0.98	60.00	0	482	4,618	0.09	1.0	11.80	0	0	0		
157	18	US60 EB (Dobson-Gilbert)	5100	2,635	617	4,483	0.12	2,600	609	0	0.99	60.00	0	609	4,491	0.12	1.0	4.27	0	0	0		
158	21	US60 EB (I-10-Dobson)	5100	5,138	822	4,278	0.16	4,879	781	0	0.95	60.00	0	781	4,319	0.15	1.0	6.25	0	0	0		
159	22	I-10 EB (40th St-US60)	5100	3,430	1,741	3,359	0.34	3,310	1,680	0	0.97	51.00	0	1,680	3,420	0.33	1.0	1.97	0	0	0		
160	41	I-10 (SR202-I-17)	5100	6,602	2,392	2,708	0.47	6,440	2,333	1,872	0.98	51.00	678	3,012	2,088	0.59	1.0	2.76	10	390	18,720		
161	43	I-10 (I-17-40th St)	5100	6,849	2,195	2,905	0.43	6,665	2,136	0	0.97	42.00	0	2,136	2,964	0.42	1.0	3.12	0	0	0		
162	45	Red Mtn (Sky Harbor Blvd-Pima Fwy)	5100	2,441	672	4,428	0.13	2,370	653	0	0.97	60.00	0	653	4,447	0.13	1.0	3.63	0	0	0		

Table E-2
Value Lane Model Results

	AG	AH	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BH	BI	BJ	BK
163	49	Price Fwy (Red Mtn Fwy-US60)	5100	5,902	1,443	3,657	0.28	6,014	1,470	0	1.02	60.00	0	1,470	3,630	0.29	1.0	4.09	0	0	0		
164	51	Maricopa Fwy (US60-Santan Fwy)	5100	2,836	504	4,596	0.10	2,773	493	0	0.98	60.00	0	493	4,607	0.10	1.0	5.63	0	0	0		
165	53	Price Fwy (US60-Chandler Blvd)	5100	3,787	696	4,404	0.14	3,761	691	0	0.99	60.00	0	691	4,409	0.14	1.0	5.44	0	0	0		
166	61	US60 (Gilbert Rd-Power Rd)	5100	1,796	307	4,793	0.06	1,771	303	0	0.99	60.00	0	303	4,797	0.06	1.0	5.85	0	0	0		
167	67	SR51 NB (Shea-Loop 101)	5100	400	64	5,036	0.01	401	64	62	1.00	61.00	10	74	5,026	0.01	1.0	6.26	10	291,350	620		
168				87,430	22,248	74,652		86,303	21,994	2,238	0.99		721	22,716	74,184					13,965	224	14,189	
169																						1.08	8.57
170	3	Pima NB(SR202-Frank Lloyd Wright)	5100	9,084	705	4,395	0.14	7,967	619	21,000	0.88	63.00	1,630	2,249	2,851	0.44	1.0	12.88	10	1,206,680	210,000		
171	6	I-10 WB (59th Ave-Agua Fria)	5100	3,338	865	4,235	0.17	3,278	849	0	0.98	60.00	0	849	4,251	0.17	1.0	3.86	0	0	0		
172	14	I-10 WB (I-17-59th Ave)	5100	5,904	1,306	3,794	0.26	5,810	1,285	0	0.98	60.00	0	1,285	3,815	0.25	1.0	4.52	0	0	0		
173	8	I-10 WB (Central-I-17)	5100	2,938	1,848	3,252	0.36	2,889	1,817	0	0.98	57.00	0	1,817	3,283	0.36	1.0	1.59	0	0	0		
174	4	I-10 EB (Central-SR51)	5100	6,306	3,624	1,476	0.71	6,323	3,634	0	1.00	39.00	0	3,634	1,466	0.71	1.0	1.74	0	0	0		
175	20	SR51 NB (I-10-Shea)	5100	3,344	365	4,735	0.07	3,337	365	0	1.00	60.00	0	365	4,735	0.07	1.0	9.15	0	0	0		
176	12	SR202 EB (SR51-Sky Harbor Blvd)	5100	8,902	1,590	3,510	0.31	8,861	1,582	0	1.00	60.00	0	1,582	3,518	0.31	1.0	5.60	0	0	0		
177	16	I-17 NB (I-10-Loop 101)	5100	5,798	491	4,609	0.10	5,698	483	0	0.98	60.00	0	483	4,617	0.09	1.0	11.80	0	0	0		
178	18	US60 EB (Dobson-Gilbert)	5100	2,635	617	4,483	0.12	2,550	597	0	0.97	60.00	0	597	4,503	0.12	1.0	4.27	0	0	0		
179	21	US60 EB (I-10-Dobson)	5100	5,138	822	4,278	0.16	5,308	849	0	1.03	60.00	0	849	4,251	0.17	1.0	6.25	0	0	0		
180	22	I-10 EB (40th St-US60)	5100	3,430	1,741	3,359	0.34	3,501	1,777	0	1.02	51.00	0	1,777	3,323	0.35	1.0	1.97	0	0	0		
181	41	I-10 (SR202-I-17)	5100	6,602	2,392	2,708	0.47	6,710	2,431	0	1.02	51.00	0	2,431	2,669	0.48	1.0	2.76	0	0	0		
182	43	I-10 (I-17-40th St)	5100	6,849	2,195	2,905	0.43	6,958	2,230	0	1.02	42.00	0	2,230	2,870	0.44	1.0	3.12	0	0	0		
183	45	Red Mtn (Sky Harbor Blvd-Pima Fwy)	5100	2,441	672	4,428	0.13	2,417	666	0	0.99	60.00	0	666	4,434	0.13	1.0	3.63	0	0	0		
184	49	Price Fwy (Red Mtn Fwy-US60)	5100	5,902	1,443	3,657	0.28	5,279	1,291	6,325	0.89	60.00	1,546	2,837	2,263	0.56	1.0	4.09	15	187,695	94,875		
185	51	Maricopa Fwy (US60-Santan Fwy)	5100	2,836	504	4,596	0.10	2,824	502	0	1.00	60.00	0	502	4,598	0.10	1.0	5.63	0	0	0		
186	53	Price Fwy (US60-Chandler Blvd)	5100	3,787	696	4,404	0.14	3,514	646	2,753	0.93	60.00	506	1,152	3,948	0.23	1.0	5.44	10	134,160	27,530		
187	61	US60 (Gilbert Rd-Power Rd)	5100	1,796	307	4,793	0.06	1,712	293	0	0.95	60.00	0	293	4,807	0.06	1.0	5.85	0	0	0		
188	67	SR51 NB (Shea-Loop 101)	5100	400	64	5,036	0.01	406	65	0	1.02	61.00	0	65	5,035	0.01	1.0	6.26	0	0	0		
189				87,430	22,248	74,652		85,342	21,980	30,078	0.99		3,683	25,663	71,237					15,285	3,324	18,609	
190																						0.64	4.74
191	3	Pima NB(SR202-Frank Lloyd Wright)	5100	9,084	705	4,395	0.14	8,978	697	0	0.99	63.00	0	697	4,403	0.14	1.0	12.88	0	0	0		
192	6	I-10 WB (59th Ave-Agua Fria)	5100	3,338	865	4,235	0.17	3,261	845	0	0.98	60.00	0	845	4,255	0.17	1.0	3.86	0	0	0		
193	14	I-10 WB (I-17-59th Ave)	5100	5,904	1,306	3,794	0.26	5,718	1,265	0	0.97	60.00	0	1,265	3,835	0.25	1.0	4.52	0	0	0		
194	8	I-10 WB (Central-I-17)	5100	2,938	1,848	3,252	0.36	2,810	1,767	0	0.96	57.00	0	1,767	3,333	0.35	1.0	1.59	0	0	0		
195	4	I-10 EB (Central-SR51)	5100	6,306	3,624	1,476	0.71	4,159	2,390	3,511	0.66	39.00	2,018	4,408	692	0.86	1.0	1.74	40	95,940	140,440		
196	20	SR51 NB (I-10-Shea)	5100	3,344	365	4,735	0.07	3,339	365	0	1.00	60.00	0	365	4,735	0.07	1.0	9.15	0	0	0		
197	12	SR202 EB (SR51-Sky Harbor Blvd)	5100	8,902	1,590	3,510	0.31	7,513	1,342	13,947	0.84	60.00	2,491	3,832	1,268	0.75	1.0	5.60	10	717,885	139,470		
198	16	I-17 NB (I-10-Loop 101)	5100	5,798	491	4,609	0.10	5,790	491	0	1.00	60.00	0	491	4,609	0.10	1.0	11.80	0	0	0		
199	18	US60 EB (Dobson-Gilbert)	5100	2,635	617	4,483	0.12	2,595	608	0	0.98	60.00	0	608	4,492	0.12	1.0	4.27	0	0	0		
200	21	US60 EB (I-10-Dobson)	5100	5,138	822	4,278	0.16	5,114	818	0	1.00	60.00	0	818	4,282	0.16	1.0	6.25	0	0	0		
201	22	I-10 EB (40th St-US60)	5100	3,430	1,741	3,359	0.34	3,424	1,738	0	1.00	51.00	0	1,738	3,362	0.34	1.0	1.97	0	0	0		
202	41	I-10 (SR202-I-17)	5100	6,602	2,392	2,708	0.47	6,636	2,404	0	1.01	51.00	0	2,404	2,696	0.47	1.0	2.76	0	0	0		
203	43	I-10 (I-17-40th St)	5100	6,849	2,195	2,905	0.43	6,924	2,219	0	1.01	42.00	0	2,219	2,881	0.44	1.0	3.12	0	0	0		
204	45	Red Mtn (Sky Harbor Blvd-Pima Fwy)	5100	2,441	672	4,428	0.13	2,078	572	4,030	0.85	60.00	1,110	1,683	3,417	0.33	1.0	3.63	10	527,700	40,300		
205	49	Price Fwy (Red Mtn Fwy-US60)	5100	5,902	1,443	3,657	0.28	5,918	1,447	0	1.00	60.00	0	1,447	3,653	0.28	1.0	4.09	0	0	0		
206	51	Maricopa Fwy (US60-Santan Fwy)	5100	2,836	504	4,596	0.10	2,802	498	0	0.99	60.00	0	498	4,602	0.10	1.0	5.63	0	0	0		
207	53	Price Fwy (US60-Chandler Blvd)	5100	3,787	696	4,404	0.14	3,728	685	0	0.98	60.00	0	685	4,415	0.13	1.0	5.44	0	0	0		
208	61	US60 (Gilbert Rd-Power Rd)	5100	1,796	307	4,793	0.06	1,759	301	0	0.98	60.00	0	301	4,799	0.06	1.0	5.85	0	0	0		
209	67	SR51 NB (Shea-Loop 101)	5100	400	64	5,036	0.01	385	62	0	0.96	61.00	0	62	5,038	0.01	1.0	6.26	0	0	0		
210				87,430	22,248	74,652		82,931	20,514	21,488	0.92		5,619	26,132	70,768					13,415	3,202	16,617	
211																						0.68	4.58
212	3	Pima NB(Shea-Mayo Blvd)	5100	11,306	1,152	3,948	0.23	11,285	1,150	0	1.00		0	1,150	3,950	0.23	1.0	9.81	0	0	0		
213	6	I-10 WB (59th Ave-Agua Fria)	10200	5,762	1,213	8,987	0.12	5,406	1,138	7,497	0.94		1,578	2,716	7,484	0.27	2.0	9.50	10	1,045,890	74,970		
214	14	I-10 WB (I-17-59th Ave)	10200	5,978	1,320	8,880	0.13	5,818	1,284	6,085	0.97		1,343	2,628	7,572	0.26	2.0	9.06	10	1,309,365	60,850		
215	8	I-10 WB (Central-I-17)	10200	2,007	1,370	8,830	0.13	1,980	1,352	1,733	0.99		1,183	2,534	7,666	0.25	2.0	2.93	10	231,060	17,330		
216	4	I-10 EB (Central-SR51)	5100	7,893	4,536	564	0.89	7,002	4,024	0	0.89		0	4,024	1,076	0.79	1.0	1.74	0	0	0		
217	20	SR51 NB	5100	5,099	322	4,778	0.06	4,762	301	0	0.93		0	301	4,799	0.06	1.0	15.83	0	0	0		
218	12	SR202 EB (SR51-Sky Harbor Blvd)	5100	15,255	2,472	2,628	0.48	14,498	2,350	0	0.95		0	2,350	2,750	0.46	1.0	6.17	0	0	0		
219	16	I-17 NB (I-10-Loop 101)	10200	9,818	729	9,471	0.07	9,709	721	0	0.99		0	721	9,479	0.07	2.0	26.94	0	0	0		
220	18	US60 EB (Dobson-Gilbert)	5100	5,858	1,372	3,728	0.27	5,908	1,384	0	1.01		0	1,384	3,716	0.27	1.0	4.27	0	0	0		
221	21	US60 EB (I-10-Dobson)	5100	10,385	1,662	3,438	0.33	10,624	1,700	0	1.02		0	1,700	3,400	0.33	1.0	6.25	0	0	0		
222	22	I-10 EB (40th St-US60)	5100	6,759	3,431	1,669	0.67	6,843	3,474	0	1.01		0	3,474	1,626	0.68	1.0	1.97	0	0	0		
223	25	I-10 WB (Agua Fria-Dysart)	5100	5,213	1,448	3,652	0.28	4,921	1,367	0	0.94		0	1,367	3,733	0.27	1.0	3.60	0	0	0		
224	27	Agua Fria (I-10-Grand Ave)	5100	1,953	202	4,898	0.04	2,347	243	0	1.20		0	243	4,857	0.05	1.0	9.66	0	0	0		
225	29	Agua Fria (Grand-75th Ave)	5100	1,408	231	4,869	0.05	1,901	312	0	1.35		0	312	4,788	0.06	1.0	6.09	0	0	0		
226	30	Agua Fria (I-17-75th Ave)	5100	3,911	641	4,459	0.13	4,011	658	0	1.03		0	658	4,442	0.13	1.0	6.10	0	0	0		
227	32	Loop 101(SR51-I-17)	5100	5,965	849	4,251	0.17	6,079	865	0	1.02		0	865	4,235	0.17	1.0	7.03	0	0	0		
228	35	Loop 101(SR51-Mayo Blvd)	5100	10,768	1,595	3,505	0.31	11,599	1,718	0	1.08		0	1,718	3,382	0.34	1.0	6.75	0	0	0		
229	37	I-17 (Loop 101-Carefree Hwy)	5100	1,245	140	4,960	0.03	1,245	140	0	1.00		0	140	4,960	0.03	1.0	8.90	0	0	0		
230	38	I-17 (Papago Fwy-Maricopa Fwy)	5100	19,059	2,897	2,203	0.57	20,047	3,047	0	1.05		0	3,047	2,053	0.60	1.0	6.58	0	0	0		
231	41	I-10 (SR202-I-17)	5100	4,526	1,640	3,460	0.32	4,625	1,676	0	1.02		0	1,676	3,424	0.33	1.0	2.76	0	0	0		
232	43	I-10 (I-17-40th St)	5100	11,341	3,635	1,465	0.71	11,624	3,726	0	1.02		0	3,726	1,374	0.73	1.0	3.12	0	0	0		
233	45	Red Mtn (Sky Harbor Blvd-Pima Fwy)	5100	4,157	926	4,174	0.18	3,992	889	0	0.96		0	889	4,211	0.17	1.0	4.49	0	0	0		
234	47	Red Mtn (Pima Fwy-Gilbert Rd)	5100	2,330	368	4,732	0.07	2,183	345	0	0.94		0	345	4,755	0.07	1.0	6.33	0	0	0		
235	49	Price Fwy (Red Mtn Fwy-US60)	5100	10,752	2,622	2,478	0.51	10,837	2,643	0	1.01		0	2,643	2,457	0.52	1.0	4.10	0	0	0		
236	51	Maricopa Fwy (US60-Santan Fwy)	5100	8,536	1,226	3,874	0.24	8,556	1,229	0	1.00		0	1,229	3,871	0.24	1.0	6.96	0	0	0		
237	53	Price Fwy (US60-Santan Fwy)	5100	7,839	1,223	3,877	0.24	7,942	1,239	0	1.01		0	1,239	3,861	0.24	1.0	6.41	0	0	0		
238	55	Santan Fwy (Maricopa Fwy-Price Fwy)	5100	2,065	415	4,685	0.08	2,036	410	0	0.99		0	410	4,690	0.08	1.0	4.97	0	0	0		
239	57	Maricopa Fwy (Santan Fwy-Germann Rd)	5100	220	114	4,986	0.02	221	115	0	1.00		0	115	4,985	0.02	1.0	1.93	0	0	0		
240	59	Santan Fwy (Price Fwy-McQueen Rd)	5100	2,413	714	4,386	0.14	2,414	714	0	1.00		0	714	4,386	0.14	1.0	3.38	0	0	0		
241	61	US60 (Gilbert Rd-Hawes)	5100	5,100	643	4,457	0.13	5,164	651	0	1.01		0	651	4,449	0.13	1.0	7.93	0	0	0		
242	63	US60 (Hawes Rd-Tomahawk)	5100	527	77	5,023	0.02	535	78	0	1.02		0	78	5,022	0.02	1.0	6.83	0	0	0		
243	65	Pima NB(SR202-Shea Blvd)	5100	2,017	429	4,671	0.08	2,021	430	0	1.00		0	430	4,670	0.08	1.0	4.70	0	0	0		
244				197,465	41,615	141,985		198,135	41,371	15,315	0.99		4,105	45,475	138,125					25,863	1,532	27,395	
245																						0.66	6.23
246	3	Pima NB	0	0	0	0	0.00	0	0	0	0.00		0	0	0	0.00	0.0	0.00	0	0	0		
247	6	I-10 WB (59th Ave-Agua Fria)	10200	3,167	820	9,380	0.08	3,188	826	689	1.01		178	1,004	9,196	0.10	2.0	7.72	10	437,880	6,890		

Table E-2
Value Lane Model Results

	AG	AH	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BH	BI	BJ	BK
248	14	I-10 WB (I-17-59th Ave)	10200	5,584	1,235	8,965	0.12	5,659	1,252	1,098	1.01		243	1,495	8,705	0.15	2.0	9.04	10	652,800	10,980		
249	8	I-10 WB (Central-I-17)	10200	2,770	1,742	8,458	0.17	2,782	1,750	304	1.00		191	1,941	8,259	0.19	2.0	3.18	10	147,000	3,040		
250	4	I-10 EB (Central-SR51)	5100	6,477	3,722	1,378	0.73	5,897	3,389	0	0.91		0	3,389	1,711	0.66	1.0	1.74	0	0	0		
251	20	SR51 NB	5100	3,398	371	4,729	0.07	3,344	365	0	0.98		0	365	4,735	0.07	1.0	9.15	0	0	0		
252	12	SR202 EB (SR51-Sky Harbor)	5100	8,827	1,576	3,524	0.31	8,593	1,534	0	0.97		0	1,534	3,566	0.30	1.0	5.60	0	0	0		
253	16	I-17 NB (I-10-Agua Fria)	5100	6,082	515	4,585	0.10	5,908	500	0	0.97		0	500	4,600	0.10	1.0	11.81	0	0	0		
254	18	US60 EB (Dobson-Gilbert)	5100	2,021	473	4,627	0.09	1,987	465	0	0.98		0	465	4,635	0.09	1.0	4.27	0	0	0		
255	21	US60 EB (I-10-Dobson)	5100	5,609	897	4,203	0.18	5,520	883	0	0.98		0	883	4,217	0.17	1.0	6.25	0	0	0		
256	22	I-10 EB (40th St-US60)	5100	3,729	1,893	3,207	0.37	3,671	1,863	0	0.98		0	1,863	3,237	0.37	1.0	1.97	0	0	0		
257	25	I-10 WB (Agua Fria-Dysart)	0	0	0	0	0.00	0	0	0	0.00		0	0	0	0.00	0.0	0.00	0	0	0		
258	27	Agua Fria (I-10-Grand Ave)	0	0	0	0	0.00	0	0	0	0.00		0	0	0	0.00	0.0	0.00	0	0	0		
259	29	Agua Fria (Grand-75th Ave)	0	0	0	0	0.00	0	0	0	0.00		0	0	0	0.00	0.0	0.00	0	0	0		
260	30	Agua Fria (I-17-75th Ave)	0	0	0	0	0.00	0	0	0	0.00		0	0	0	0.00	0.0	0.00	0	0	0		
261	32	Loop 101(SR51-I-17)	0	0	0	0	0.00	0	0	0	0.00		0	0	0	0.00	0.0	0.00	0	0	0		
262	35	Loop 101(SR51-Mayo Blvd)	0	0	0	0	0.00	0	0	0	0.00		0	0	0	0.00	0.0	0.00	0	0	0		
263	37	I-17 (Loop 101-Carefree Hwy)	0	0	0	0	0.00	0	0	0	0.00		0	0	0	0.00	0.0	0.00	0	0	0		
264	38	I-17 (Papago Fwy-Maricopa Fwy)	0	0	0	0	0.00	0	0	0	0.00		0	0	0	0.00	0.0	0.00	0	0	0		
265	41	I-10 (SR202-I-17)	5100	7,032	2,548	2,552	0.50	6,832	2,475	0	0.97		0	2,475	2,625	0.49	1.0	2.76	0	0	0		
266	43	I-10 (I-17-40th St)	5100	7,378	2,365	2,735	0.46	7,241	2,321	0	0.98		0	2,321	2,779	0.46	1.0	3.12	0	0	0		
267	45	Red Mtn (Sky Harbor Blvd-Pima Fwy)	5100	2,164	596	4,504	0.12	2,172	598	0	1.00		0	598	4,502	0.12	1.0	3.63	0	0	0		
268	47	Red Mtn (Pima Fwy-Gilbert Rd)	0	0	0	0	0.00	0	0	0	0.00		0	0	0	0.00	0.0	0.00	0	0	0		
269	49	Price Fwy (Red Mtn Fwy-US60)	0	0	0	0	0.00	0	0	0	0.00		0	0	0	0.00	0.0	0.00	0	0	0		
270	51	Maricopa Fwy (US60-Santan Fwy)	5100	3,754	667	4,433	0.13	3,718	660	0	0.99		0	660	4,440	0.13	1.0	5.63	0	0	0		
271	53	Price Fwy (US60-Santan Fwy)	0	0	0	0	0.00	0	0	0	0.00		0	0	0	0.00	0.0	0.00	0	0	0		
272	55	Santan Fwy (Maricopa Fwy-Price Fwy)	0	0	0	0	0.00	0	0	0	0.00		0	0	0	0.00	0.0	0.00	0	0	0		
273	57	Maricopa Fwy (Santan Fwy-Germann Rd)	0	0	0	0	0.00	0	0	0	0.00		0	0	0	0.00	0.0	0.00	0	0	0		
274	59	Santan Fwy (Price Fwy-McQueen Rd)	0	0	0	0	0.00	0	0	0	0.00		0	0	0	0.00	0.0	0.00	0	0	0		
275	61	US60 (Gilbert Rd-Hawes)	5100	1,391	238	4,862	0.05	1,366	234	0	0.98		0	234	4,866	0.05	1.0	5.85	0	0	0		
276	63	US60 (Hawes Rd-Tomahawk)	0	0	0	0	0.00	0	0	0	0.00		0	0	0	0.00	0.0	0.00	0	0	0		
277	65	Pima NB(SR202-Shea Blvd)	0	0	0	0	0.00	0	0	0	0.00		0	0	0	0.00	0.0	0.00	0	0	0		
278				69,383	19,660	72,140		67,878	19,117	2,091	0.97		613	19,730	72,070					12,377	209	12,586	
279																						0.37	3.82
280																							

Table E-3
Description of Six Candidate Value Lane Corridors

Candidate HOT Lane Options

#	HOT Lane Configurations:	*# Lanes*	**2010** *# Lane Miles*	**2010** *# toll zones*	**2020** *# Lane Miles*	**2020** *# toll zones*	**Toll Verification Zones?**	**Toll Viol. Rates Est.**	**Est. Viol. Image Capture Rates**	**Operations**
1	I-10/Papago	2	21.5	2x4	25.1	2x5	**Yes**	2.5%	90%	24 Hours
2	US60 & I-10 (to 3rd St.)	1	25.9	2x12	25.9	2x12	No	5.0%	30%	Peak Periods
3	SR-51/Squaw Peak	1	15.8	2x8	15.8	2x8	No	5.0%	30%	Peak Periods
4	L-101/Pima & Price	1	22.5	2x10	22.5	2x10	**Yes**	2.5%	90%	24 Hours
5	L-101/Pima	1	12.9	2x6	12.9	2x6	**Yes**	2.5%	90%	24 Hours
6	L-202/RedMountain	1	9.2	2x3	10.6	2x4	No	5.0%	30%	Peak Periods

Table E-4
Simplified Freeway Traffic Basics

Level of Service (LOS)	Vehicle/Capacity Ratio (V/C)	Vehicle Volumes* (vehicles/lane/hour)	Vehicle Speeds (mph)
F	Various	Various	Various
E	1.0	2200-2300	58-60
D	0.72-0.88	2015*	63
C	0.72-0.75	1644	68.5
B	0.49-0.51	1120	70
A	0.30-0.32	700	70

*** For HOV or Value lanes, recommended maximum is 1500 v/l/hr for one-lane facility and 1700 v/l/hr for two-lane facility in order to be at or above LOS D.**

Since the models are forecasting vehicle to capacity (V/C) ratios over 1.1 for the general purpose lanes during peak periods in the predominant commute directions, we estimate that a threshold of (or better than) LOS D should provide relative speeds and time savings sufficient to make the Value Lanes attractive to HOVs and to toll-paying motorists. For the two-adjacent lane configuration of the Value lane design (e.g., on I-10/Papago, candidate 1) envisioned for this Study, LOS D as an operating limit means that the traffic volume in the Value Lanes should be kept at or below 1,700 vehicles per hour per lane. Note that in one-lane configurations (i.e., the other candidates shown in Table E-3), the Value Lane LOS D goal would limit the traffic volume to be at or below 1,500 per lane per hour. Dynamic value pricing, such as that implemented on the I-15 Express Lanes in San Diego, provides the demand management means to have that control. However, the MAG traffic model does not have the capability to represent true dynamic pricing on Value lanes, so value pricing was determined using judgment (and iterative adjustments to the toll rates used for the models' traffic forecasts) based upon reasonable assumptions and traffic engineering principles. Likewise, the models do not represent the HOV scofflaws or the toll violators, both of whom use up the available carpool lanes' capacities. Therefore, to perform a realistic fiscal evaluation, the scofflaws have been included, by reducing the patronage volumes and toll revenues bv the estimated violation rates (as discussed further in the next subsection). The assumptions and principles used to incorporate these issues in this evaluation are discussed in the next few subsections.

E.1.4 HOV Scofflaw Rates and Impacts

The traffic models do not include motorists who violate the laws and drive in the carpool lanes although they do not have the required number of occupants. These HOV scofflaws use the excess capacity in the carpool lanes, which is the asset being offered for those willing to pay a toll. Caltrans rates HOV scofflaw rates of 10% as good and 5% as excellent. As noted in the guiding principles of the main body of the report (see subsection 2.3.3), the goal is to achieve those rates via increasing violation enforcement. HOV scofflaw rates will actually vary as a function of congestion (and frustration) as well as the numbers of DPS officers deployed for HOV violation enforcement. Experience in value lane operations, gained from the I-15 Express Lanes, is showing that the HOV scofflaw rates definitely decrease when the legal toll alternative is offered and the enforcement officer presence on the HOV facility is kept high and visible. Therefore, the recurring operating costs for the Value lanes, discussed below, assumes that an extra DPS presence (i.e., 4000 hours and 320,000 miles per year) must be maintained to preserve the lane capacity for those honest carpools and those non-HOVs willing to pay tolls. This Value lane investment in HOV violation enforcement should maintain the HOV scofflaw rates between 5% and 10%. In addition, there will be additional revenues resulting from the HOV violation fines as a result of this vigorous enforcement. However, the resulting increase in HOV violation fines, is not included in this fiscal analysis as a "return on investment." This is viewed as an unmeasured, positive side benefit of operating the value lanes.

Note that HOV scofflaws exist in carpool lanes throughout the country and they exist independent of the Value Lane concept. Studies of the I-15 Express Lanes seem to indicate that providing motorists with the toll paying option under a Value Lane operation lowers HOV scofflaw rates. The DPS officers do their best to enforce the HOV requirements, but counting occupants is difficult with modern vehicles' styles and window tint treatments. In our opinion, the best deterrence to the HOV scofflaws is the presence of DPS officers and the posting of large signs indicating the size of the fine for HOV use violations. However, congested general-purpose lanes and frustrated motorists prevent elimination of HOV violations. Thus, any fiscal evaluation needs to include these HOV scofflaws as part of a realistic assessment. Also, note that HOV scofflaws are different than toll violators in ways that will be discussed and clarified below.

Nonetheless, for the Study's financial assessment, the analysis assumes that all the traffic model's estimates of "legal" HOV traffic include the HOV scofflaws. This represents a loss in potential carpool capacity that needs to be minimized through vigorous enforcement and, in the real world, cannot be ignored. The HOV enforcement "investment" in operating costs, along with the presence of several video cameras that could assist HOV enforcement in the toll collection zones, should maintain the HOV scofflaw rates to between 5 and 10%.

E.1.5 Patronage and Revenue Forecasts

The model results in Table E-2 form the basis for the patronage estimates of this analysis.

Demand and Time Savings Conclusions — As mentioned above in subsection E.1.3, the conclusion drawn from the model results is that there appears to be a high level of demand for the available Value Lanes' capacity for toll-payers at toll rates at or above $0.10/mile. Similarly, we conclude from the model results that there is sufficient time saving in using the Value Lanes versus the general-purpose lanes to reward the toll payer. Indeed, as was noted in the SR- 91 Express Lanes user surveys and measurements for the evaluation effort led by Dr. Ed Sullivan of Cal Poly San Luis Obispo, the motorists' perceived time savings are much more than their actual time savings. This perception is not included in the MAG model. It is mentioned here to indicate that the patronage forecast in the MAG model, which is based upon actual travel time saving, is believed to be lower than the motorists are likely to respond.

Effects of Toll Rate Changes — Previous public opinion polls (especially the SR-91 (West) HOT Lane Feasibility Study conducted by Parsons for the Orange County Transportation Authority, OCTA) have shown, to a first order of approximation, for tolls between $0.10 and $0.40 per mile, that the percentage of willing toll payers is inversely proportional to the percentage change of the toll rates. That is, a 20% increase in the toll rates (e.g., from $0.20 to $0.25 per mile) reduces the toll traffic by about 20% during peak periods. (Note that this applies as an approximation, since in the limit there appears to be a small group of motorists who will, on certain days, always be willing to pay the toll at any reasonable rate. These are the high-value of time motorists who are the opposite of those who are never willing to pay tolls.) The MAG region's public opinion poll regarding toll rates, see Figure 2-20, is basically the same for those who would use the Value Lanes more than 50% of the time. For example, 31% would pay $1.00 to save 15 minutes, but only 15% would pay $2.00 to save 15 minutes. For the occasional potential Value lane users (e.g., 20% of the time or one day per week), the Study's poll results for toll rate sensitivity were also similar, just at a somewhat higher level of participation. For that set of poll respondents, 43% would pay $1.00 to save 15 minutes, and 23% would pay $2.00. Again, the elasticity is nearly inversely proportional to the percentage change of the toll rates. This elasticity was used for the MAG model runs.

The price sensitivity of MAG region drivers realistically willing to pay tolls should be confirmed and evaluated further as part of future public opinion polls which would be needed to support a bond-rating patronage and revenue forecast. Note that this initial financial feasibility effort is intended to provide estimates of future patronage and revenue, but is not sufficient to support a bond indenture.

Patronage Estimation and Gross Toll Revenue Estimation — At this point, an actual modeling case (namely, Candidate #1, the four-lanes on I-10, Papago, that represents expected HOT2 conditions, will be used to explain and illustrate the methodology. In Table E-5, HOT2 Revenue Estimates [Candidate 1], the AM peak hour modeling results for the eastbound (EB) motorists in the Value lanes, are shown for each of the EB toll segments. The HOV2 volumes are shown along with the toll-payer volumes in 2010, and 2020, as discussed above. Similarly, the results for the westbound (WB) motorists in the Value Lanes are shown for each of the WB toll segments.

The values shown for 2010 in Table E-5 are taken directly from the traffic demand modeling information in Table E-2. For example, the 2010 AM peak period's EB toll-payer traffic volumes on the 4.5-mile segment between 59th Avenue and I-17 is represented by a VMT of 29,097 for the three hour period (i.e., 1070 vehicles/hour in the two lanes) for a toll rate of $0.45/mile. The toll revenue for the three-hour period is thus $13,094 (= $0.45/mile x 29,097 vehicle-miles).

The toll-payer volumes are limited due to the HOV2 demand forecasted by the MAG model. Thus, in 2010, there are two levels of toll rates on the EB segments: $0.45/mile between 79th Avenue and I-17, about six miles, and $0.30/mile for the three miles between I-17 and 3rd Avenue. These toll rates maintain the total HOT lanes' volumes under LOS D for each of the toll segments. The total potential toll revenue for the AM peak period in 2010 for this example of the EB HOT lanes on I-10 is shown to be $25,863. The WB or outbound toll traffic is light, as is the carpool volume. The minimum toll rate of $0.10/mile is selected for all the toll segments; and, in 2010, for the AM peak period, a potential revenue of $1,532 is estimated by this methodology.

The results for 2020 are also shown in Table E-5 for I-10 following these same methods. Although congestion is worse on the general-purpose lanes, because the HOV2 traffic is higher, then the potential toll revenues are forecast to be somewhat less than 2010: $21,589 for the EB and $1,681 for the WB toll-payers.

These peak period toll revenues are decreased by the assumed toll violation rates (e.g., 2.5% in Case 1) discussed further below. Then, the peak period toll revenues for the PM peak period are estimated by assuming AM/PM symmetry. That is, the AM period's toll revenue is doubled to obtain that day's peak periods' toll revenues.

Standard traffic engineering estimation methods would normally show that up to half of the daily traffic on freeways can occur during the off peak periods. This off-peak estimate is considered a low-end conservative bound to be used for this fiscal feasibility Study. The off-peak toll revenues are conservatively estimated to be equal to two hours of the AM peak toll revenue. Conservative, because the off-peak traffic is usually about equal to the two peak periods' traffic, but we estimate that those willing to pay a toll are much fewer in number during the off-peak periods. Hence, we assume that the off-peak revenues are about 33% of the peak periods for this "new" facility. Note that for the "conversion" HOT lanes, such as the US60 corridor, there are no off-peak revenues included since the lanes are opened for general use.

The sum of these peak and off-peak daily estimates is used to represent the Monday through Friday total revenues. Then, the weekend daily revenues are estimated to be 30% of the week-day levels. These daily revenue estimates for each year are used to compute weekly revenues. Then, a factor of 50.6 weeks per year (used to account for

Table E-5

I-10/Papago (79th to 3rd Ave.) HOT2 Revenue Estimates

HOT2+

Operating four lanes (two in each direction) as HOT 2 lanes:

	Flags	**Y2020** lane miles	**Y2020** EB/inbound *toll/mile*	*toll VMT*	*revenue ($)*	**Y2020** WB/outbound *toll/mile*	*toll VMT*	*revenue ($)*	**Y2010** lane miles	**Y2010** EB/inbound *toll/mile*	*toll VMT*	*revenue ($)*	WB/outbound *toll/mile*	*toll VMT*	*revenue ($)*
Estimated AM Toll Traffic (Peak Period)															
Dysart to Agua Fria	24 & 25	3.6	25.0	5,983	$1,496	10.0	2,915	$292	3.6	0.0	0	$0	0	0	$0
Agua Fria to 59th Ave.	5 & 6	9.5	30.0	19,590	$5,877	10.0	4,424	$442	9.5	45.0	23,242	$10,459	10	7,497	$750
59th Ave. to I-17	13 & 14	9.1	45.0	25,382	$11,422	10.0	6,562	$656	9.1	45.0	29,097	$13,094	10	6,085	$609
I-17 to Central	7 & 8	3.0	40.0	6,987	$2,795	10.0	2,905	$291	3.0	30.0	7,702	$2,311	10	1,733	$173
total=		**25.1**			$21,589			$1,681	**21.5**			$25,863			$1,532

Estimated AM Peak Period Toll Revenues in 4 Lanes (reduced by assumed violation rate)

		Y2020 EB/inbound	**Y2020** WB/outbound	**Y2010** EB/inbound	**Y2010** WB/outbound
violation rate=	**2.5%**	$21,050	$1,639	$25,217	$1,493

Estimated Toll Revenues in 4 Lanes			**Y2020**	**Y2010**
Week Day Peak Period Totals: 2 x AM Peak Period			$45,377	$53,420
Week Day Off-Peak Total:(2 AM Pk. Dir. Hrs.)			$14,033	$16,811
Daily Week Day Totals:			$59,410	$70,231
Daily Weekend Day Total:	**week day x**	**30%**	$17,823	$21,069
Weekly Totals:			$332,695	$393,291
Yearly Totals (50.6xWeekly):			$16,834,344	$19,900,547
Est. Net Annual Violation Revenues:			$2,055,519	$2,110,565
Net Yearly Totals (Tolls +Viol.'s):			$18,889,862	$22,011,113
Yearly Toll Processing Costs:				
@ $0.10 per transaction			($688,785)	($694,245)
@ $0.25 per transaction			($1,721,963)	($1,735,613)
"fixed recurring HOT lane costs"			($1,200,241)	($1,200,241)
Net Annual Revenues:				
@ $0.10 per transaction			$17,000,836	$20,116,626
@ $0.25 per transaction			$15,967,658	$19,075,259

holidays) is used to compute the annual gross toll revenues for the HOT2+ alternative. These are seen to be almost $20 million in 2010 and $17 million in 2020 for the example in Table E-5 on I-10. The total annual net toll violation revenues from Table E-6, which will be explained in subsection E.1.6 below, are then added to these values in Table E-5 for each of the two years (2010 and 2020) to obtain a gross annual toll/net violation revenues estimate.

The remaining calculations in Table E-5 to estimate the net revenues will be discussed below in Section E.1.8.

E.1.6 Toll Violations

As there are HOV scofflaws, experience in the electronic tolls industry is that there is a low, steady level of toll violators where there are no toll gates, no toll attendants, and no law officer enforcement of violations. The national experience and the “local” experience, nearby in Southern California, is that electronic toll violations run at 2 to 5% of the toll transactions. Technology exists and has been installed in a number of toll roads to capture images of toll violators' license plates with a high accuracy. Also, as discussed in Section 11.2 of the Final Report, California civil code laws are in place to permit toll authorities to fine motorists up to $76 and to place "holds" on those motorists' annual vehicle registration with the Department of Motor Vehicles (DMV) to enforce payment of these fines and unpaid tolls. Nevertheless, there is a small set of motorists who believe that they can "beat the system" and drive on the toll roads without valid toll debit accounts and/or electronic transponders. The Value lane facility's violation enforcement system assumed for this study should recover the majority of these violators' tolls, but at a cost over and above the normal electronic toll collection costs. Therefore, for completeness and because the toll violation fines are a potentially significant source of toll revenues, the effects of toll violators are included in this fiscal assessment. For the "expected" conditions for Case 1, the conservative toll violation rate of 2.5% (the national average estimated by the International Bridge, Turnpike and Tunnel Association, IBTTA, from surveys of its' member toll authorities) was used. In other cases below, toll violation rates of 5% are evaluated.

For Value Lanes, a toll violator is a non-HOV motorist who while driving in the Value Lanes drives through the toll verification lane without a transponder or with a transponder without a good debit account. The signage will need to be developed that makes it clear that a motorist driving into the "Electronic Tolls Only" lanes must have a valid electronic toll collection (ETC) transponder and account or be in violation of the proposed civil code which can lead to a fine (see Final Report Section 11, which recommends toll violation regulations). We have assumed that these or similar regulations are in place, and we have assumed that the fine is about $50, which is similar to the fine in California, which is $76. The toll violators normally would be notified by mail via the vehicle's license plate image captured electronically by the automated toll violation enforcement system while in the toll collection and/or verification zone. The toll authority performs collection using fees, fines and (when necessary) placing a "hold" at the DMV until the toll violation payments are made. On the other hand, an HOV scofflaw is a non-HOV motorist who drives through the adjacent HOV-Only lanes at the toll collection zones on the Value Lanes. The signage will make it clear that if a motorist is an HOV scofflaw (i.e., violator of the vehicle code driving in the HOV-Only zone) that they will be subject to the HOV violation fine (in California, at least $271). The HOV scofflaws will be ticketed by the DPS as with current carpool violation enforcement. Collection of the vehicle code for HOV violation is performed by traffic court of the local jurisdiction.

Table E-6 provides the basis for the net toll violation revenue estimates for each of the 2010 and 2020 forecast years for the Candidate 1, I-10/Papago alternative, discussed previously in Table E-5. The calculation for the number of annual toll violations for the assumed 2.5% rate follows the methodology used to estimate the toll patronage. One key, conservative assumption is that the toll violators will drive the length of the Value lane such that the number of violators is the peak value of the toll violations in all the toll segments, rather than the sum of the segments' violators. This is considered to be conservative as it minimizes the toll violation revenue potential. Likewise, in the conditions shown in Table E-6, the levels of toll violation enforcement are "patron friendly" and assume that the toll authority is only pursuing the repeat toll violators. Note that the net effect of this conservatism could underestimate the toll violation revenues by as much as a factor of two or three. In addition, this estimation approach is equivalent to the Value lane's toll authority adopting a policy of charging one violation for the violator who drives the entire Value lane. The toll violation costs are based upon realistic factors experienced by electronic toll operations. The toll violation processing costs are increased by a 40% contingency factor for further conservatism.

The methodology is somewhat complex, but for completeness it will be reviewed for this example Candidate 1, I-10. As seen in Table E-6, the gross toll revenues are taken from Table E-5 for each of the years modeled (2010 and 2020). The lost revenues due to the 2.5% toll violation rate are computed based upon a straightforward percentage of the gross potential revenues (e.g., 2.5% of $17 million for 2020). Next comes some coarse estimation to approximate the number of toll violators. Table E-7 uses the data in Table E-2 and Table E-5 to develop an estimate of the number of toll transactions for each of the two model years (2010 and 2020). This is an approximation needed for the violation calculation being discussed here as well as to compute the toll revenue processing costs, as will be discussed below. As shown, the total annual number of toll transactions is about 6.9 million for both years. Using the gross toll revenues from Table E-5 and the toll transactions computed here, the average gross toll per transaction is computed in Table E-7 as $2.87 in 2010 and $2.44 in 2020. (As a reasonableness check, this is useful.) These averages are used in Table E-6 to compute the number of toll violators (i.e., toll revenues lost due to violators divided by the average toll per transaction yields an estimated number of violations for that year). In our example, this is about 178K in 2010 and 176K in 2020. The average gross toll revenues per transaction are shown as part of the patronage summary data in Table 7-5 of the Final Report.

Next, the number of good toll violation images is computed from the estimated number of annual toll violators 90% for the "new" Value Lanes that have a toll verification lane, and only 30% for the "conversions" that do not have a toll verification/turnout lane.

Table E-6

I-10/Papago (79th to 3rd Ave.) HOT2 Toll Violation Revenue Estimates

HOT2 Toll Violation Revenues:		**2020**	**2010**
Operating four lanes (two in each direction) as HOT 2 lanes:			
Potential Gross Toll Revenues:		$17,265,994	$20,410,818
Toll Violation Rate:			
2.5%			
Toll Revenues Lost to Violators:		$431,650	$510,270
Estimated annual Violators=		176,612	178,012
Toll Violation Revenues:			
Violation Accounts=Images Captured (90%)	90%	158,950	160,210
Collections:	*fee*		
25% patrons paid-by-plate (admin fee+toll)	$5	$295,809	$315,074
25% violators paying full fine + fee + toll	$50	$2,282,690	$2,317,704
25% no DMV match/written off	$0	$0	$0
25% collection agency (33% success):	$50	$753,288	$764,842
Gross Toll Violation Revenues:		$3,331,787	$3,397,620
Violation Processing Costs:	*cost*		
VES Image Processing (all)	$0.50	$79,475	$80,105
Violation Notices-DMV (50% of images)	$3	$238,426	$240,316
Collection agency share (50%)	50%	$376,644	$382,421
VES Facilities & Maintenance Annual Costs	as shown	$100,000	$100,000
VES Operators' cost (~1 FTE/100K accts)	$30/hr.	$187,200	$187,200
Miscellaneous (contingency)	30%	$294,523	$297,013
Total Cost of Processing Violations:		$1,276,268	$1,287,055
Net Revenues from Toll Violations:		**$2,055,519**	**$2,110,565**
Average Net Revenue per Violator:		**$11.64**	**$11.86**

I-10/Papago (79th to 3rd Ave.) HOT2 Toll Transaction Estimates

HOT2+

Operating four lanes (two in each direction) as HOT 2 lanes:

	Flags	Y2020 lane miles	**Y2020** EB/inbound toll/mile	toll VMT	#vehicles avg. #	**Y2020** WB/outbound toll/mile	toll VMT	#vehicles avg. #	**Y2010** lane miles	**Y2010** EB/inbound toll/mile	toll VMT	#vehicles avg. #	WB/outbound toll/mile	toll VMT	#vehicles avg. #
Estimated AM Toll Traffic (Peak Period)															
Dysart to Agua Fria	24 & 25	3.6	25.0	5,983	1,676	10.0	2,915	810	3.6	0.0	0	0	0	0	0
Agua Fria to 59th Ave.	5 & 6	9.5	30.0	19,590	4,133	10.0	4,424	931	9.5	45.0	23,242	4,903	10	7,497	1,578
59th Ave. to I-17	13 & 14	9.1	45.0	25,382	5,603	10.0	6,562	1,449	9.1	45.0	29,097	6,423	10	6,085	1,343
I-17 to Central	7 & 8	3.0	40.0	6,987	4,737	10.0	2,905	1,983	3.0	30.0	7,702	5,222	10	1,733	1,183
Max. Value=					5,603			1,983				6,423			1,578
Min. Value=					4,133			931				4,903			1,183
Basis of estimate: [2 x (max.value) - min.value]=					7,073			3,035				7,943			1,974

approximation representing ticketed tolls

Estimated AM Peak Period Toll Transactions in 4 Lanes (reduced by

		Y2020 EB/inbound	Y2020 WB/outbound	Y2010 EB/inbound	Y2010 WB/outbound
violation rate=	**2.5%**	6896	2959	7744	1924

Estimated Toll Transactions in 4 Lanes			**Y2020**	**Y2010**
Week Day Peak Period Totals: 2 x AM Peak Period			19,710	19,338
Week Day Off-Peak Total:(2 AM Pk. Dir. Hrs.)			4,598	5,163
Daily Week Day Totals:			24,308	24,500
Daily Weekend Day Total:	**week day x**	**30%**	7,292	7,350
Weekly Totals:			136,124	137,203
Yearly Totals (50.6xWeekly):			6,887,852	6,942,451
Yearly Toll Processing Costs:				
fees @ $0.10 per transaction			$688,785	$694,245
fees @ $0.25 per transaction			$1,721,963	$1,735,613
"fixed recurring HOT lane costs"			$1,200,241	$1,200,241
Annual Total Operating Costs:				
fees @ $0.10 per transaction			$1,889,026	$1,894,486
fees @ $0.25 per transaction			$2,922,204	$2,935,854
Operating Costs per Transaction:				
fees @ $0.10 per transaction			$0.27	$0.27
fees @ $0.25 per transaction			$0.42	$0.42
Gross Toll Revenues per Transaction:			$2.44	$2.87
Gross Revenues per Transaction			$2.74	$3.17

The toll industry state of the technology is to be able to capture license plates for 90% of violators when the toll system can automatically determine that a violation has occurred. This is the expectation assumed where there is a verification lane for image capture of violators. When the violation must be decided by an observer, who must check to see if the vehicle is a carpool or a toll violator manually (using video images), then we estimate that the probability of violation detection and image capture is much less. We estimate that this could be as low as 30% for lanes without verification lanes (i.e., only 1/3 of the rate assumed for the "new" lanes presumably with verification lanes).

We have assumed that some enforcement enabling legislation is enacted in Arizona to provide a means of collecting on violations of the toll lanes. We have used the California civil code's toll violation elements to represent the return on the toll violations. As can be seen in Table E-5, we estimate that of the toll violations with images of the violating vehicles' license plates (needed for proof of the violation) the collection effort will result in the following distribution of toll violation revenues:

- 25% will pay for the toll plus a administrative handling fee ($5 used as a low cost level intended to only recover processing, administration and mailing costs),
- 25% will pay for the toll plus the handling fee ($5) and the toll fine ($50 used in this fiscal analysis, although California allows $76),
- 25% will not have a match with the Department of Motor Vehicles (DMV) records or the address is not valid such that the toll violations are not recoverable and are written off by the agency and/or operator (i.e., no payment by violator), and
- 25% will be sent to a collection agency with about 33% success of collecting the toll plus the fine ($50).

This is based upon experience in the electronic toll industry in California and considered typical: around 50% of the violations are recovered through the various alternatives created by the California legislation.

The toll violation processing costs are also shown in Table E-5 to be estimated as follows:

- $0.50 per violation image is included to represent the average cost of determining the license plate (partially automated using optical character reader processors, but often checked by a person) — for all violations with good license plate images;
- $3.00 per violation image sent electronically to the DMV for collection (DMV hold processing fee) — for 50% of the violation images;
- Half of all collection agency violation revenues are assumed to be retained by the collection agency as representative of a typical fee arrangement, although that can vary — this is applied only for those violators who pay via the collection agency;
- $100,000 annual "facilities costs" for the violation enforcement system (VES) are included to cover the base fixed costs to operate;
- Staffing costs for VES account maintenance is estimated to be one full time equivalent (FTE) person per 100,000 violations plus one supervisor; and

- Contingency for other, unspecified costs equal to 40% of the total costs described above.

These are included as representative of the toll violation processing and collection fees. The major collection cost items are as represented in Table E-5, as described here. The inclusion of 40% cost contingency is selected to be typical for fiscal feasibility studies of this nature.

Hence, the total toll violation revenues, $3.33 million in 2020 in Table E-5 for our example, are then reduced by the total violation processing costs, $1.28 million in our example to show a yield for toll violations of $2.05 million per year. This is a fairly conservative representation of VES net revenue. Note that this net toll violation revenue of about $2 million, in our example, compares favorably to the tolls lost to these violators of about $0.43 million (as shown in Table E-5). The expected return for toll violations when there is no automated method (i.e., no toll verification lane) is much less. For example, if the spreadsheet in Table E-5 were set at 30% for good license plate image capture (e.g., no toll verification lane), then the net toll violation revenue would be about $0.52 million — much closer to the lost tolls.

Finally, at the bottom of Table E-5, we show the average net toll violation revenue per violation for the I-10/Papago example. This is provided for comparison purposes and is seen to be $11.64 in 2020 in our example. This compares favorably to our gross toll revenue per transaction computed in Table E-7 of $2.44. As above, if there is no toll verification lane, then the net violation revenue per violation would drop from $11.64 to about $2.93. The message for this is that toll violation collection is lucrative and that on average toll violators pay a premium to violate, which is the intent. The actual fees and fines would be adjusted within the framework of the Arizona regulations (what is actually passed by the legislature for toll violation collection) to achieve approximately the levels described here.

E.1.7 Costs for Value Lane Implementation and Operation

Toll System Capital Costs — The cost estimate for the example of the Value Lanes' Toll System's non-recurring capital expenditures on I-10/Papago is shown in Table E-8. This is an estimate of what would be spent in order to implement the Value lanes' toll system and infrastructure. Unit costs and quantities have been developed as shown in Table E-8 for the recommended initial phase of the 19.9 lane-mile facility to be implemented around 2010 — see Figure 7-4. In addition, in this example, the cost of the second phase (an added 1.6 lane miles, to be implemented after the HOV lanes are extended to the west past the L-101/Agua Fria interchange with the I-10) is also shown in Table E-8 under the “>2010” heading. The on-site (or “in lane”) toll system items are generically illustrated in Figure 2-19. For this top-level financial feasibility evaluation, one can see that these toll system costs which include 30% contingency (i.e., $9.3 million for the “2010” phase and $1.3 million for the “>2010” phase) are relatively minor (less than 5%) compared to the freeway improvement construction costs and are being included primarily for completeness. Note that, for the initial phase shown as “2010,” there are 5 toll segments in each direction which requires a total of 8 toll collection zones in this Value Lane alternative on I-10.

Table E-8

I-10 HOT Lanes Capital Expenditures

	Unit Costs	Quantity	2010 Total	Unit Costs	Quantity	>2010 Total
Toll System & Infrastructure						
CMS	$85,000	10	$850,000	$85,000	2	$170,000
CMS Installation	$100,000	10	$1,000,000	$100,000	2	$200,000
Toll Zone Construction	$50,000	8	$400,000	$50,000	1	$50,000
On Site Toll Equipment	$200,000	8	$1,600,000	$200,000	1	$200,000
Communications Equipment	$750,000	1	$750,000	$75,000	1	$75,000
Added Fixed Signage	$30,000	8	$240,000	$10,000	10	$100,000
Pavement Delineators	$25	6,450	$161,250	$25	2,160	$54,000
Surveillance Cameras	$3,000	48	$144,000	$3,000	6	$18,000
Camera Poles & Installation	$2,000	48	$96,000	$2,000	6	$12,000
Host Computer	$500,000	1	$500,000			
Host Software	$250,000	1	$250,000			
Traffic Center Equipment	$125,000	1	$125,000			
Management						
Management	$300,000	1	$300,000		1	$0
PS&E/System Oversight	$350,000	1	$350,000		1	$0
Marketing (Pre-Opening)	$150,000	1	$150,000	$50,000	1	$50,000
Transponders	$25	10,000	$250,000	$25	3,000	$75,000
Contingency	30%	1	$2,149,875	30%	1	$301,200
		TOTALS=	$9,316,125		**TOTALS=**	$1,305,200

The suggested infrastructure improvements are underground conduit runs under the freeway for power and telephone lines (from the median to the toll equipment located along the right shoulder), new signage for the value lanes (both fixed and changeable), pavement delineators at 12-foot intervals, sign bridges, camera poles, and paint. Modifications to the median barrier to accommodate changeable message signs (CMS) are also required. Estimates of the backroom, Host computer and software are included, although this might be provided if this function were shared with another toll operator (e.g., Caltrans, TCA or CPTC in California or Public Highway Authority in Colorado, etc.). The on-site toll equipment (sensors, cameras, computers and installation) cost of $200,000 per toll collection zone is a conservative estimate that includes the violation enforcement license plate imaging capability and highly reliable, self-monitoring equipment. Management for the implementation and startup marketing costs are also included as shown in Table E-8. The electronic toll transponder costs of about $25 are shown only for needed stock on hand (e.g., 10,000 tags) as it assumed that the primary transponder costs (e.g., for 50,000 or more tags) are initially offset by pre-paid toll account balances (e.g., $35) required to establish patron debit accounts.

Recurring Costs for Value Lanes Operation and Maintenance — The estimated "fixed" annual recurring costs for operation and maintenance of the I-10 Value Lanes example are provided in Table E-9. These estimates follow the recurring costs developed for a 10-mile HOT lane facility analyzed in the 1997 SR-91 (West) HOT Lanes Feasibility Study that were refined in the more recent, 1999 SR-57 HOT Lanes Feasibility Study for OCTA as well as the 1999 SR-14 HOT Lanes Study for SCAG. Note the DPS costs are included, as noted previously, although this is only to accomplish vigorous enforcement of the HOV violations. Estimates for "extra" ADOT maintenance (e.g., pavement repairs and to replenish the pavement delineators) are shown. The "fixed" annual recurring cost subtotals are estimated to be about $1.2 million for this I-10/Papago Value Lanes facility, as indicated in Table E-9.

As shown at the bottom of Table E-5, the major additional toll operations cost is the per transaction fees which are estimated to range from $0.10 to $0.25 per transaction. Although, electronic toll processing costs per toll transaction must be developed in association with the operator, the most recent survey from the IBTTA has shown that the average operating costs for electronic tolls is approximately $0.11 per transaction. However, direct experience with California toll operations, including the Transportation Corridor Agencies (TCA) in Orange County, indicates that this is more representative of the low end of the range of toll operations costs. To represent the lower-cost end and the higher-cost end, toll processing costs of $0.10 and $0.25 per transaction, respectively, were used in this fiscal feasibility in all cases examined to bound this variable cost.

The example Value Lane candidate on I-10, annual number of toll transactions for each of the two model years is shown in Table E-7 following the same methodology that was used to estimate the toll patronage and revenues. As shown at the bottom of Table E-7, the toll processing annual costs for $0.10 and for $0.25 per transaction are calculated. Hence, a range of two levels of cost is being assessed to establish upper and lower bounds for this recurring, variable cost factor. For example, the 6.9 million toll

Table E-9

I-10 HOT Lanes Recurring Costs

Recurring Costs:	Unit Costs	Quantity	Total ($/Year)
Enforcement and Security:			
- DPS: labor	$60	4,000	$240,000
mileage	$0.40	80,000	$32,000
- Security and Roadway Assistance	$50,000	1	$50,000
Administration:			
- Authority management	$150,000	1	$150,000
- Authority auditing	$50,000	1	$50,000
Transponders:	($25)	4,000	-$100,000
- Toll Account Balances (offsetting cash flow)	$25	5,000	$125,000
Maintenance:			
- Toll System Software	$12,500	1	$12,500
- Toll System Hardware	$198,450	1	$198,450
- Pavement Delineators	$25	1,613	$40,313
Marketing:	$125,000	1	$125,000
Contingency (~30%):			$276,979
		Subtotal=	**$1,200,241**
Toll Operations and Collection:			
- Fee per Transaction*	***Range:***	***$0.10 to $0.25 per transaction***	

*Assumed Ticketing Type toll collection

transactions forecast for 2010 in Table E-7 could cost either $0.7 million or $1.7 million to process. This range of variable costs are added to the “fixed” annual costs estimated in Table E-9 to produce total annual recurring operation and maintenance costs for 2010 of between $1.7 and 2.9 million. To put these costs in perspective, the next lines in Table E-7 show these operating costs at between $0.27 and $0.42 per transaction. Then, the next set of lines in Table E-7 compute the average value for each toll transaction. This shows that, in 2010 for this example, the average gross revenue per toll transaction would bring in $2.87 which can be compared to the per transaction toll processing costs of between $0.27 and $0.42 per transaction. Furthermore, the example in Table E-7 further shows the gross revenue per transaction when toll violation net revenues are included to be about $3.17 in 2010.

One other key assumption being made in the toll cost per transaction methodology being used herein is that a toll "transaction" is the total trip along the Value Lanes facility that is being taken by that toll-payer. This is referred to as "ticketing" toll collection by the tolls industry since it means that the cost of that toll transaction is computed by the distance and the rates for the toll segments traveled for that trip. For reference, this is the method of tolling on the Pennsylvania and New Jersey Turnpikes. The other method of tolling most often used is referred to as “barrier” tolling in which everyone who drives through this toll zone pays a given toll. This is the method used for toll bridges, tunnels and many toll roads such as the Toll Roads in Orange County, California, operated by TCA. The assumption of “ticketing” tolls for the Value Lanes is being used in the methodology here since it provides a better visualization of how the tolls will be computed (i.e., on a per mile basis). Actually, either tolling method will work on a HOT Lane. However, for the proposed Maricopa alternative facilities, with multiple ingress/egress locations, being evaluated here, the “ticketing” toll collection seems more appropriate and descriptive. In addition, this provides a lower-cost basis for defining a toll “transaction” in the computation of toll processing costs.

E.1.8 Net Revenue Estimation

In Table E-5, for the example being used to explain the methodology, the I-10/Papago, Candidate 1, the toll processing costs and the other recurring costs are repeated from the corresponding tables of computations and used to compute the net revenues for the two model years (2010 and 2020). As can be seen by the bottom line, net revenues per year, there is a significant potential for Value Lanes revenues. In Table E-5 for our example on I-10, the annual net revenues are shown as $19 to $20 million in 2010 (after at least a one-year startup, as discussed below) and in 2020 between $16 to $17 million per year. Therefore, the cumulative 30-year totals for this example case could be over $500 million.

E.1.9 Cash Flow Analysis

Startup Year — In the immediately preceding discussions, the 2010 designations are used to denote the initial year of operation for the I-10 example value lanes, as analyzed in Tables E-5 through E-9. However, these estimates are actually more representative of 2011, since the initial year of operation will build slowly and only achieve 60% to 80% of the forecast (i.e., potential) revenue levels. It was deemed sufficient for this study to acknowledge awareness of that well-known phenomenon, in all cash flow and other fiscal evaluations, the initial year (2010) will need to be adjusted to account for first year toll startup. An actual cash flow analysis will need to consider this startup year. However, we did not go into analyses of the annualized cash flow except to estimate the magnitude of the toll revenue bonds that these net revenues might support, as will be discussed in the next subsection.

E.1.10 Toll Revenue Bonds and Debt Coverage Requirements

Toll revenue bonds usually require a debt coverage ratio of from 1.3 to 2.0. That is, the bonds would be backed by net toll revenues that would exceed the debt service payment by between 30% and 100%. The higher the debt coverage ratio, the lower the risk to bond holders; therefore, the lower the interest that would be needed to sell the bonds. Any sophisticated level of fiscal bond analysis was not attempted for this feasibility task, however some assumptions and "rules of thumb" have been used to estimate the amount of money that the projected toll revenue stream could finance. We have assumed that a debt coverage ratio of about 1.3 would be sufficient for "reasonable" tax-exempt bonds (interest rates that would be similar to the toll revenue bonds that have funded the Toll Roads under TCA). However, the annual net revenues vary with time, so the usual, simple computation of net present value of the future cash flow cannot be used. Rather a simple rule of thumb was used for this fiscal analysis -- which was checked and confirmed by a very conservative, net present value computation. The rule of thumb is that net annual cash flow should be sufficient to cover between 9 and 10 times that level. In other words, $20 million of annual cash after expenses should be sufficient to cover the debt service (and fund) bonds for between $180 and $200 million. For conservatism, we have elected to use the factor of “nine” as a measure of the toll revenue bonds. For simplicity that result is presented below for estimated bond levels. However, note that these are relatively conservative since time-varying annual payments are often arranged to permit larger bonds to be established and sold. Again, although we kept it simple, we have confirmed this "rule of thumb" as being quite reasonable based upon the net present value of the cash flow forecasts.

To complete the example of I-10 value lanes, our top-level fiscal assessment of this case indicates that the net revenues of between $19 million and $20 million may be sufficient to finance about $175 million in toll revenue bonds in 2010. Similarly, the 2020 net toll revenues of between $16 and $17 million could finance about $150 million. This is shown in Table 7-6 of the Final Report. Thus, more than twice the total $75 million for construction costs (discussed further below) could potentially be funded via toll revenue bonds for the example I-10 value lane alternative developed here.

E.1.11 Toll VMT Estimates

In comparing the alternatives, the toll vehicle miles traveled (VMT) was estimated using the similar methodology as for the patronage and revenue estimates, which were shown in Table E-5. This VMT estimation methodology is illustrated in Table E-10 for the I-10 example being used here. The peak AM period VMT from the MAG model was doubled to estimate the AM and PM peak toll traffic. The off-peak toll traffic VMT was estimated using two of the AM peak period's hours. The week day toll VMT was the sum of the peak and off-peak periods. The weekend toll VMT was estimated to be 30% of the weekday toll traffic. The weekly toll VMT totals were calculated (using 5 average week days and 2 weekend days) and multiplied by 50.6 (weeks/year) to estimate the annual VMT. The toll VMT estimates for 2010 and 2020 are shown in Table E-10 to be 54.0 and 53.3 million, respectively. This provides the estimation basis for the VMTs used to prioritize the value lane alternatives that were included in the results summary of Table 7-6.

Table E-10

I-10/Papago (79th to 3rd Ave.) HOT2 VMT Estimates

HOT2+

Operating four lanes (two in each direction) as HOT 2 lanes:

	Flags	Y2020 lane miles	**Y2020** EB/inbound toll/mile	toll VMT	revenue ($)	**Y2020** WB/outbound toll/mile	toll VMT	revenue ($)	**Y2010** lane miles	**Y2010** EB/inbound toll/mile	toll VMT	revenue ($)	WB/outbound toll/mile	toll VMT	revenue ($)
Estimated AM Toll Traffic (Peak Period)															
Dysart to Agua Fria	24 & 25	3.6	25.0	5,983	$1,496	10.0	2,915	$292	3.6	0.0	0	$0	0	0	$0
Agua Fria to 59th Ave.	5 & 6	9.5	30.0	19,590	$5,877	10.0	4,424	$442	9.5	45.0	23,242	$10,459	10	7,497	$750
59th Ave. to I-17	13 & 14	9.1	45.0	25,382	$11,422	10.0	6,562	$656	9.1	45.0	29,097	$13,094	10	6,085	$609
I-17 to Central	7 & 8	3.0	40.0	6,987	$2,795	10.0	2,905	$291	3.0	30.0	7,702	$2,311	10	1,733	$173
total=		**21.5**		57,942	$21,589		16,806	$1,681	**25.1**		60,041	$25,863		15,315	$1,532

Estimated AM Peak Period Toll Revenues in 4 Lanes (reduced by assumed violation rate)

		Y2020 EB/inbound	WB/outbound	**Y2010** EB/inbound	WB/outbound
violation rate=	**2.5%**	$21,050	$1,639	$25,217	$1,493

Estimated Toll VMT in 4 Lanes			**Y2020**	**Y2010**
Week Day Peak Period Totals: 2 x AM Peak Period			149,496	150,712
Week Day Off-Peak Total:(2 AM Pk. Dir. Hrs.)			38,628	40,027
Daily Week Day Totals:			188,124	190,739
Daily Weekend Day Total:	**week day x**	**30%**	56,437	57,222
Weekly Totals:			1,053,494	1,068,140
Yearly Totals (50.6xWeekly):			53,306,817	54,047,897

Table E-11

Summary of Patronage Results for Recommended HOT Lanes Case Alternatives

Alternative	#Lanes/ direction	Type	Year	Length (miles)	AM Peak Toll Volumes (v/l/hr.)	Average Gross Toll/ transaction
I-10/ Papago	2	New	2010	10.7	~1200	$2.87
			2020	12.6	~1100	$2.44
US 60/Superstition & I-10/ Maricopa	1	Conversion	2010	25.9	~800	$2.48
			2020	25.9	~920	$2.79
SR-51/ Squaw Peak	1	Conversion	2010	15.8	~730	$3.98
			2020	15.8	~740	$4.37
L-101/ Pima & Price	1	New	2010	22.5	~780	$2.72
			2020	22.5	~790	$3.94
L-101/ Pima	1	New	2010	12.9	~780	$3.94
			2020	12.9	~645	$5.40
L-202/Red Mountain	1	Conversion	2010	9.2	~840	$2.09
			2020	9.2	~860	$2.62

E.2 RECOMMENDED HOT CASE FINANCIAL RESULTS DETAILS

As previously defined in Table E-3, there were six candidate value lanes that were evaluated for fiscal feasibility for the Recommended HOT Case. Of these six candidates, the #5 candidate in Table E-3 (i.e., the alternative of only L-101/Pima — rather than Pima and Price) was not included in the final listing of recommended candidates provided in Section 7 of the Final Report. The summary results for the remaining five candidates are shown in the Final Report in Tables 7-5 and 7-6. The summary results for all six candidates analyzed and discussed here are shown in Tables E-11 and E-12 below.

The conclusion, that all the candidates appear to be fiscally viable, is discussed in further detail in Section 7 of the Final Report.

E.3 ENHANCED HOT CASE RESULTS

Table E-13 describes the three corridors in the Enhanced HOT Case developed and analyzed during the study under Task 7. The MAG model was adjusted (and we believe improved as a result) between the later Recommended HOT Case (November 2000) and the earlier Enhanced HOT Case (September 2000). There are differences, but overall the study conclusions reached were not affected by these differences.

The conclusions for these three candidate corridors from the Enhanced HOT Case were that all are viable as potential value lanes facilities. However, as noted in Section 7.1 of the Final Report, the high construction costs (primarily right-of-way acquisition costs) for the I-17 corridor of over $1 billion preclude this alternative from being self-funding as a value lane. The other candidate corridors were considered to be viable and merit further study.

The detailed Enhanced HOT Case detailed fiscal evaluation results are the summary results are shown in the Final Report in Tables 7-1 and Tables 7-2.

Table E-12

Summary of Fiscal Results for Recommended HOT Lanes Case Alternatives

Alternative *[Type]*	Year	Annual Toll VMT	Average Estimated Net Annual Revenues	Estimated 30-year Bond* which could be funded	Estimated Construction Costs**	Estimated Toll System Implementation Costs	Total Costs to Build Value Lanes
I-10/ Papago	2010	54M	**~$19.5M**	**~$175M**	$66M	$9.3M	**$75M**
[new]	2020	53M	**~$16.5M**	**~$150M**	+$13M	+$1.3M	**+$14M**
US60/ Superstition & I-10/ Maricopa	2010	39M	**~$9.9M**	**~$90M**	--	$20.0M	**$20M**
[conversion]	2020	52M	**~$11.3M**	**~$100M**	--	--	**--**
SR-51/ Squaw Peak	2010	13M	**~$5.1M**	**~$45M**	$30M	$14.8M	**$45M**
[conversion]	2020	15M	**~$6.8M**	**~$60M**	--	--	**--**
L-101/ Pima & Price	2010	56M	**~$11.5M**	**~$100M**	$82M	$38.3M	**$120M**
[new]	2020	57M	**~$14.8M**	**~$130M**	--	--	**--**
L-101/ Pima	2010	35M	**~$8.8M**	**~$80M**	$50M	$25.7M	**$76M**
[new]	2020	31M	**~$11.0M**	**~$100M**	--	--	**--**
L-202/Red Mountain	2010	22M	**~$5.5M**	**~$50M**	--	$8.1M	**$8M**
[conversion]	2020	26M	**~$6.0M**	**~$55M**	--	--	**--**

* Government-backed Bond
** Excludes funded HOV construction, includes new HOV lane and connector costs.

Table E-13
Description of Three Enhanced HOT Case Corridors

Enhanced HOT Lane Case

#	HOT Lane Configurations:	# Lanes	2010 # Lane Miles	2010 # toll zones	2020 # Lane Miles	2020 # toll zones	Toll Verification Zones?	Toll Viol. Rates Est.	Est. Viol. Image Capture Rates	Operations
1	I-10/Papago	2	19.9	2x4	21.5	2x5	**Yes**	2.5%	90%	24 Hours
2	L-101/Pima	1	-	-	14.6	2x4	**No**	5.0%	30%	24 Hours
3	I-17/Black Canyon	2	-	-	27.0	2x7	**Yes**	2.5%	90%	24 Hours

E.4 SENSITIVITY ANALYSES FOR KEY ASSUMPTIONS

The effect on toll revenues and costs was assessed for two sets of alternative operations during the study. The impact on toll revenues for operations during peak periods only (for value lanes implemented as “conversions” from existing HOV lanes) versus the preferred mode of 24-hour operation was assessed as one variation. In addition, the cost and revenue impact of operation with and without the toll/HOV verification lanes in the toll zones for “one-lane” facilities was also evaluated during the study. The summary results of these two sensitivity analyses are provided in the following two subsections. The detailed results were developed using the same methodology as defined in Section E.1 above and are not included since these results are only being used to demonstrate the effect of these alternatives.

E.4.1 Periods of Operation (24-Hour vs. Peak Periods)

The results of the sensitivity analyses for the estimated effect on toll patronage and revenue of only operating during peak periods versus all day are summarized in Table E-14. Three candidate HOT lanes corridors are listed with annual toll VMT and net annual revenues (from tolls and violations) estimates for both periods of operation. As shown, for the three candidate corridors, the impact of shortening the operations to only during peak periods is to reduce the net revenue by a range of between 33% and 40% depending upon the corridor. The toll VMT is reduced by about 30%. This is representative of off-peak operations when congestion is less and toll rates would be lower.

In general, full-time operation is preferred for HOT lanes, since the operating costs are not significantly reduced by shortening the operating period (due to automation) and the revenue reduction is fairly significant (e.g., 33 to 40% by this analysis). However, to improve the likelihood of acceptance, the initial value lanes pilot project in the MAG region may need to only operate during peak periods, at least initially. This is especially true if the HOT lanes are to be operated on “converted” HOV lanes. Hence, the Recommended HOT Case used the lower revenues from the shorter period of operations for each of the “conversion” corridors.

Table E-14
Toll Patronage and Net Revenue Impact of 24-Hour vs. Peak Period Operation

HOT Lane Alternative	Operation	Year	Estimated Annual Toll VMT	Net Annual Revenue (tolls & violations)	*Revenue "Cost"*
SR-51/ Squaw Peak*	24-Hour	2010	19.8 million	~$8.5 million	
		2020	21.1 million	~$10.9 million	
	Peak Periods	2010	13.3 million	~$5.1 million	***reduced 38-40%***
		2020	14.5 million	~$6.8 million	
L-202/ Red Mountain*	24-Hour	2010	30.2 million	~$8.7 million	
		2020	34.2 million	~$8.9 million	
	Peak Periods	2010	22.5 million	~$5.5 million	***reduced 33-37%***
		2020	25.6 million	~$6.0 million	
L-101/ Pima/Price	24-Hour	2010	56.0 million	~$11.5 million	
		2020	57.0 million	~$14.8 million	
	Peak Periods	2010	41.3 million	~$7.0 million	***reduced 38-39%***
		2020	42.5 million	~$9.8 million	

*Without Toll/HOV Verification Zones

E.4.2 With and Without Toll/HOV Verification Zones

The recommended configuration for the HOT lanes of having a toll/HOV verification zone allows accurate, automated toll violation enforcement via capturing digital images of license plates for those vehicles without pre-paid transponders. The estimated license plate capture rate is about 90% based upon toll industry estimates as long as it can be automated. These toll/HOV verification lanes are described in subsection 2.4.3 of the Final Report.

Single-lane HOT facilities could use an additional lane at the toll collection zones for automated toll/HOV verification. To allow for a merge back into one lane, the two-lane area would need to be about 0.75 miles. And, assuming the ROW is available, the lane construction cost is $700 to $800 thousand per toll zone per direction. So, although preferred, the toll verification turnout lanes can double the HOT lane implementation costs — even where the ROW is available. And, when the ROW is not available, acquiring the ROW makes this even more cost-prohibitive. However, there is a toll revenue "cost" which is also significant.

If the toll/HOV verification lanes are not included, the expectation is that the toll violation rates will increase from the 2.5% levels to closer to 5%. And, without the toll/HOV verification lanes, the much less effective manual verification method (e.g., observer uses multiple cameras to determine if motorist is solo or in carpool, and if solo without a transponder, then activates violation enforcement system) would be used. This would provide a 30% capture rate for toll violators, at best.

In Table E-15, three of the corridors are evaluated for HOT lane implementation costs, with and without the toll verification zones, as well as for net annual toll revenues. As can be seen, the implementation costs for having the toll/HOV verification zones are sometimes twice as much as without them. For example, the 12 zones on the US60 alternative cost an additional $12.5 million to implement. On the other hand, the estimated revenue “cost” is also fairly significant (e.g., from 15% to 37% reduction). In the US60 example, the reduction is $2 million per year, which implies a breakeven point for the $12.5 million in implementation costs of slightly over six years.

From this evaluation, we conclude that the actual design of the HOT lanes needs to be tailored, depending upon available ROW and the need for revenue to fund the construction. For this study, we have assumed that new construction of HOT lanes will have the toll/HOV verification zones and that “conversions” will not have them.

Table E-15
Toll Patronage and Net Revenue Impact With and Without Toll Verification Zones

HOT Lane Alternative	**Toll/HOV Verification Zones**	**HOT Lane Implement-ation Costs**	**Year**	**Net Annual Revenue (tolls & violations)**	***Revenue “Cost”***
SR-51/ Squaw Peak*	2x8	$31.5 million	2010	~$8.5 million	
			2020	~$10.9 million	
	None	$14.8 million	2010	~$5.3 million	***($3.2 M/yr)***
			2020	~$6.8 million	***($4.1 M/yr)***
L-202/ Red Mountain*	2x3	$14.3 million	2010	~$6.2 million	
			2020	~$6.6 million	
	None	$8.1 million	2010	~$5.5 million	***($0.7M/yr)***
			2020	~$6.0 million	***($0.6M/yr)***
US60 & I-10/Maricopa*	2x12	$32.5 million	2010	~$11.8 million	
			2020	~$13.3 million	
	None	$20.0 million	2010	~$9.8 million	***($2.0M/yr)***
			2020	~$11.3 million	***($2.0M/yr)***

*Peak Period Operation

E.5 BUSINESS AND ECONOMIC IMPACTS

E.5.1 Business Impacts

On the basis of improved travel times in these alternative value lanes corridors for both value lanes' users and mainline users, positive effects are expected for the proposed program. The reduced travel time will likely translate to reduced business and employee costs for travel in these corridors. Some of these cost savings may appear in the form of reduced wear and tear on employee commuters using these corridors, while others may be in the form of reduced delivery and freight costs of business dependent upon these potential value lanes corridors.

This conclusion is supported by the results of the evaluation of the business impacts of the I-15 Express Lanes value pricing project in San Diego, which is roughly comparable to one of these alternative corridors. While an initial I-15 Phase I business impact study found that the majority of the businesses either did not know whether the I-15 program would have an impact or thought that it would have no impact on their business[1], a follow up study found that businesses dependent upon the I-15 corridor may perceive the I-15 Express Lanes program as positive for their business compared with a group of businesses not dependent on the corridor[2]. The follow-up study better segregated the data to identify businesses actually dependent upon the I-15 corridor as opposed to simply being located within the corridor. The analysis found that 45 percent of businesses dependent on the I-15 corridor thought that the I-15 Express Lanes program was of high or medium important to business performance compared with only 10 percent of those dependent on the I-8 control corridor. The remaining 55 percent of respondents thought that the I-15 Express Lanes program was of low or no importance to business performance.

E.5.2 Economic Impacts

Similarly, the travel time saving in both the value lanes and the mainline lanes that are generated by the value lanes suggest that the economic impacts of the proposed value lanes will be positive. In general, the region would have reduced adverse congestion impacts with the proposed lanes than without. For example, the I-10/Papago and the L-101/Pima/Price value lanes (one new HOV facilities) are forecast to serve over 50 million toll vehicle miles traveled (VMT) in 2020 (see Figure 7-10). These toll-payer VMT totals are primarily moving from the congested general-purpose freeway lanes and the major arterial streets to travel at or above LOS D speeds. These translate into significant travel hours saved both for the toll paying vehicles and the non-toll paying vehicles. The travel time saved then translates to reduced vehicle operating costs and increased economic output.

[1] Golob, Jacqueline et al, *Task 3.2.4, Phase I Business Impact Study,* Prepared for SANDAG by San Diego State University Foundation, March 30, 1998

[2] Higgins, Thomas J. and Will Johnson, *I-15 Congestion Pricing Project – Secondary Analysis of Phase I Business Impact Study Data Set*, KT Analytics, September 22, 1998

And even though some commuters and other travelers are paying a price for the Value Lanes time saving, the economic benefits would also be positive even to the group paying the toll. Because there is a choice between using the value lanes and the mainline lanes, the value lane users are always responding to perceived benefits of time savings and increased travel time reliability that are worth paying for. In economic terms, they are consequently better off for being able to act in their own interests. The economic benefit to the users would be equal to the sum of the tolls and the consumer surplus. Consumer surplus is the additional amount of money that the value lane users would be willing to pay for the time saving above the toll that they are charged. Consumer surplus is a measure of the worth of the travel time saving to the toll payers. Depending upon the toll price, the consumer surplus can be as large or larger than the value of the tolls paid.

APPENDIX F

Summary of Data Collected
For 1996 Occupancy Study

Conducted by ADOT
(Summary Produced by MAG)

1-10 @ 31 Ave		East Bound (3 + 1 HOV lane)			West Bound (4 + 1 HOV lane)			Average
		6:30-8:30	10:00-14:00	16:00-18:00	6:30-8:30	10:00-14:00	1600-1800	
SOV lanes (veh/hr)	Drive alone	4,680	2,948	3,615	3,727	3,140	5,408	3,701
	2 persons	357 (79.5)	768 (85.1)	800 (83.9)	322 (82.4)	654 (87.3)	799 (84.2)	640 (84.7)
	3+ persons	92 (20.5)	134 (14.9)	153 (16.1)	69 (17.6)	95 (12.7)	150 (15.8)	115 (15.3)
HOV lanes (veh/hr/ln)	Drive alone	171	220	32	27	141	77	129
	2 persons	901 (91.7)	176 (83.0)	255 (87.0)	175 (85.8)	138 (82.6)	924 (88.8)	360 (87.9)
	3+ persons	82 (8.3)	36 (17.0)	38 (13.0)	29 (14.2)	29 (17.4)	117 (11.2)	50 (12.1)
Violation (%)		14.8	-	9.8	11.7	-	6.9	10.9

1-10 @ 32 St		East Bound (4 + 1 HOV lane)			West Bound (4 + 1 HOV lane)			Average
		6:30-8:30	10:00-14:00	16:00-18:00	6:30-8:30	10:00-14:00	1600-1800	
SOV lanes (veh/hr)	Drive alone	4,162	3,834	6,604	7,973	3,553	3,369	4,610
	2 persons	570 (82.5)	652 (85.8)	572 (83.9)	384 (87.9)	770 (88.3)	1,033 (79.3)	675 (84.7)
	3+ persons	121 (17.5)	108 (14.2)	110 (16.1)	53 (12.1)	102 (11.7)	269 (20.7)	122 (15.3)
HOV lanes (veh/hr/ln)	Drive alone	20	469	69	84	146	41	181
	2 persons	130 (83.3)	133 (86.4)	600 (89.0)	423 (83.9)	119 (86.9)	221 (79.8)	235 (85.6)
	3+ persons	26 (16.7)	21 (13.6)	74 (11.0)	81 (16.1)	18 (13.1)	56 (20.2)	39 (14.4)
Violation (%)		11.4		9.3	14.3		12.9	11.7

1-10 @ 3St & 16St		East Bound (5 + 1 HOV lanes)			West Bound (5 + 1 HOV lanes)			Average
		6:30-8:30	10:00-14:00	16:00-18:00	6:30-8:30	10:00-14:00	1600-1800	
SOV lanes (veh/hr)	Drive alone	5,868	3,948	6,599	6,674	4,500	5,356	5,174
	2 persons	644 (82.7)	911 (84.7)	765 (78.1)	580 (84.3)	1,087 (87.5)	857 (83.0)	855 (84.3)
	3+ persons	135 (17.3)	164 (15.3)	215 (21.9)	108 (15.7)	155 (12.5)	176 (17.0)	159 (15.7)
HOV lanes (veh/hr/ln)	Drive alone	65	249	71	82	321	88	181
	2 persons	453 (86.0)	200 (88.9)	627 (86.1)	665 (87.7)	301 (91.2)	786 (87.5)	442 (87.9)
	3+ persons	74 (14.0)	25 (11.1)	101 (13.9)	93 (12.3)	29 (8.8)	112 (12.5)	61 (12.1)
Violation (%)		11.0	-	8.9	9.8	-	8.9	9.5

1-17 @ N. Peoria Ave		North Bound (3 + 1 HOV lanes)			South Bound (3 + 1 HOV lanes)			Average
		6:30-8:30	10:00-14:00	16:00-18:00	6:30-8:30	10:00-14:00	1600-1800	
SOV lanes (veh/hr)	Drive alone	3,409	3,252	4,646	4,500	3,777	3,958	3,821
	2 persons	480 (80.7)	547 (90.3)	610 (92.0)	263 (86.8)	746 (89.7)	887 (79.7)	603 (87.0)
	3+ persons	115 (19.3)	59 (9.7)	53 (8.0)	40 (13.2)	86 (10.3)	226 (20.3)	91 (13.0)
HOV lanes (veh/hr/ln)	Drive alone	147	100	69	58	75	52	85
	2 persons	113 (76.4)	120 (88.9)	113 (75.8)	222 (89.9)	81 (85.3)	197 (82.4)	131 (84.2)
	3+ persons	35 (23.6)	15 (11.1)	36 (24.2)	25 (10.1)	14 (14.7)	42 (17.6)	25 (15.8)
Violation (%)		49.8	-	31.7	19.0	-	17.9	29.4

Lp.202 @ 24St & 32St		East Bound (3 + 1 HOV lane)			West Bound (3 + 1 HOV lane)			Average
		6:30-8:30	10:00-14:00	16:00-18:00	6:30-8:30	10:00-14:00	1600-1800	
SOV lanes (veh/hr)	Drive alone	5,102	3,311	5,490	5,606	3,395	4,572	4,273
	2 persons	437 (86.9)	617 (91.1)	519 (86.9)	346 (80.3)	523 (87.8)	688 (81.1)	534 (86.7)
	3+ persons	66 (13.1)	60 (8.9)	78 (13.1)	85 (19.7)	73 (12.2)	160 (18.9)	82 (13.3)
HOV lanes (veh/hr/ln)	Drive alone	66	249	102	105	367	94	200
	2 persons	241 (89.6)	194 (89.0)	627 (87.3)	446 (85.9)	153 (89.0)	444 (84.3)	307 (87.2)
	3+ persons	28 (10.4)	24 (11.0)	91 (12.7)	73 (14.1)	19 (11.0)	83 (15.7)	45 (12.8)
Violation (%)		19.7	-	12.4	16.8	-	15.1	15.3

I-17 @ N. McDowell Rd		North Bound (4 + 0 HOV lanes)			South Bound (4 + 0 HOV lanes)			Average
		6:30-8:30	10:00-14:00	16:00-18:00	6:30-8:30	10:00-14:00	1600-1800	
SOV lanes (veh/hr)	Drive alone	3,428	3,040	4,085	5,286	3,499	3,710	3,698
	2 persons	569 (76.3)	725 (83.7)	670 (82.4)	572 (85.1)	907 (88.4)	996 (79.6)	759 (83.6)
	3+ persons	177 (23.7)	141 (16.3)	143 (17.6)	100 (14.9)	119 (11.6)	255 (20.4)	149 (16.4)
HOV lanes (veh/hr/ln)	Drive alone	-	-	-	-	-	-	-
	2 persons	-	-	-	-	-	-	-
	3+ persons	-	-	-	-	-	-	-
Violation (%)		-	-	-	-	-	-	-